Model 1000A
Gas Chromatograph

Hardware Reference Manual

Applies to Both
Daniel Danalyzer Model 1000A
Rosemount Analytical Model 1000A

Part Number 3-9000-750
Revision A

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EMERSON
Process Management

Model 1000A Gas Chromatograph
Hardware Reference Manual

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- Read all instructions prior to installing, operating, and servicing this product.
- Follow all warnings, cautions, and instructions marked on and supplied with this product.
- Inspect the equipment packing case and if damage exists, notify your local carrier for liability.
- Open the packing list and carefully remove equipment and spare or replacement parts from the case. Inspect all equipment for damage and missing parts.
- If items are missing, contact your local Product Services Department representative or the sales office. Provide the equipment serial number and sales order number to the Product Services Department or sales representative.

  All returned equipment or parts must have an RMA (Returned Materials Authorization) form obtained from the Products Services Department. Complete the Customer Problem Report or include a letter describing the problem and corrective action to be performed at the factory.

  Phone: 1 (713) 827-5033
- Physically attach the RMA, corrective action documentation, and a copy of the packing list to the equipment and place inside the shipping case. An envelope with a copy of the packing list may be attached to the outside of the shipping case. Send to the address shown above.
- Install equipment as specified per the installation instructions and per applicable local and national codes. All connections shall be made to proper electrical and pressure sources.
- Ensure that all equipment doors are closed and protective covers are in place, except when maintenance is being performed by qualified persons, to prevent personal injury.
- Use of this product for any purpose other than its intended purpose may result in property damage and/or serious injury or death.
- Before opening the flameproof enclosure in a flammable atmosphere, the electrical circuits must be interrupted.
- Repairs must be performed using only authorized replacement parts as specified by the manufacturer. Use of unauthorized parts can affect the product's performance and place the safe operation of the product at risk.
- When installing or servicing ATEX certified units, the ATEX approval applies only to equipment without cable glands. When mounting the flameproof enclosures in a hazardous area, only flameproof cable glands certified to IEC 60079-1 must be used.

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TABLE OF CONTENTS

DESCRIPTION

1.1 PURPOSE OF THIS MANUAL 1-1

1.2 INTRODUCTION 1-2

1.3 FUNCTIONAL DESCRIPTION 1-3

1.4 MINIMUM PC REQUIREMENTS 1-5

1.5 MODES OF OPERATION 1-6

1.5.1 User Interface 1-6

1.5.2 Capabilities 1-7

1.6 THEORY OF OPERATION 1-8

1.6.1 Analyzer Detector 1-8

1.6.2 Data Acquisition 1-10

1.6.3 Peak Detection 1-11

1.6.4 Basic Analysis Computations 1-13

1.7 GLOSSARY 1-16

EQUIPMENT DESCRIPTION

2.1 SAMPLING SYSTEM 2-1

2.1.1 Sampling Point Location 2-2

2.1.2 Sample Volume and Flow Rate 2-2

2.1.3 Sample Conditioning 2-3

2.1.4 Contamination Precautions 2-3

2.1.5 Valving 2-3

2.1.6 Calibration Gas 2-3

2.2 ANALYZER 2-4

2.2.1 Physical Description 2-4

2.2.2 Chromatograph Valves 2-5

2.2.3 Detector Subsystem 2-6

2.2.4 Analyzer Preamplifier Unit 2-6
2.2.5 Analyzer Specifications 2-7
2.2.6 Utility Gas Requirements 2-8

2.3 ELECTRONIC ASSEMBLY 2-8
2.3.1 Controller Hardware Configurations 2-8

INSTALLATION AND SETUP

3.1 PRECAUTIONS AND WARNINGS 3-3
3.1.1 Hazardous Environments 3-3
3.1.2 Power Source Wiring 3-4
3.1.3 Signal Wiring 3-5
3.1.4 Electrical and Signal Ground 3-6
3.1.5 Electrical Conduit 3-8
3.1.6 Sample Systems Requirements 3-9

3.2 PREPARATION 3-10
3.2.1 Introduction 3-10
3.2.2 Site Selection 3-10
3.2.3 Unpacking the Unit 3-11
3.2.4 Necessary Tools and Components 3-12
3.2.5 Optional Tools and Components 3-13

3.3 INSTALLING THE ANALYZER 3-14
3.3.1 Analyzer AC Power Wiring 3-14
3.3.2 Sample and Gas Lines 3-15

3.4 SETTING THE COM ID 3-18
3.4.1 Inspect or Change the Com ID 3-18
3.4.2 Preparing for Serial Connections 3-22
3.4.3 FTB Connection (RS-232) 3-24
3.4.4 PC to GC Cable Short Distance Connection (RS-232) 3-25
3.4.5 Long Distance Connection (RS-422, RS-485) .. 3-32

3.4.6 Ethernet Connection (Optional) 3-33
3.4.7 GC-Printer Wiring 3-34
3.4.8 Discrete Digital I/O Wiring 3-35
3.4.9 Analog Input Wiring 3-38
3.4.10 Analog Output Wiring 3-39
3.4.11 Optional Boards 3-41

3.5 ANALYZER LEAK CHECKS AND PURGING FOR FIRST CALIBRATION 3-43
3.5.1 Analyzer Leak Checks 3-43
3.5.2 Purging Carrier Gas Lines 3-44
3.5.3 Purging Calibration Gas Lines 3-46

3.6 SYSTEM START-UP 3-47

MAINTENANCE AND TROUBLESHOOTING

4.1 HAZARDOUS ENVIRONMENTS 4-1

4.2 TROUBLESHOOTING AND REPAIR CONCEPT ... 4-2

4.3 ROUTINE MAINTENANCE 4-2
4.3.1 Bimonthly Maintenance Checklist 4-2
4.3.2 Routine Maintenance Procedures 4-4
4.3.3 Contact Service 4-4

4.4 ACCESS TO GC EQUIPMENT ELEMENTS 4-4
4.4.1 Electrical/Electronic Components 4-4
4.4.2 Detector Elements, Heater Elements, Valves and Columns 4-7

4.5 PRECAUTIONS FOR HANDLING PC ASSEMBLIES 4-9

4.6 GENERAL TROUBLESHOOTING 4-9
4.6.1 Hardware Alarms 4-9
4.6.2 Troubleshooting Checklist 4-12
4.6.3 Test Points Dual Methods Board and FTB 4-15

4.6.4 Preamplifier 4-17
4.6.5 Flow Balance Check 4-17
4.6.6 Temperature 4-17
4.6.7 FID Configuration 4-19

4.7 LEAK CHECKS 4-20
4.7.1 Field Service 4-20
4.7.2 Factory Level Leak Check 4-21
4.7.3 Plugged Lines, Columns, or Valves 4-23

4.8 CHROMATOGRAPH VALVES 4-24
4.8.1 Required Tools 4-24
4.8.2 Chromatograph Valve Replacement Parts 4-24
4.8.3 Valve Cleaning 4-25
4.8.4 Valve Overhaul 4-25
4.8.5 TCD Replacement 4-27
4.8.6 Micro-FID Removal 4-29
4.8.7 Micro-FID Maintenance 4-31
4.8.8 Micro-FID Re-assembly 4-32

4.9 TCD DETECTOR BRIDGE BALANCE 4-32

4.10 MEASURE VENT FLOW 4-35

4.11 MODEL 1000A ELECTRICAL COMPONENTS .. 4-36
4.11.1 DC Power Supply Replacement Procedures 4-39

4.12 COMMUNICATIONS 4-40

4.13 ANALOG INPUTS/OUTPUTS 4-43
4.13.1 Model 1000A Analog Inputs 4-44
4.13.2 Analog Output Adjustment 4-45
4.13.3 Model 1000A Analog Outputs 4-46

4.14 DISCRETE DIGITAL INPUTS/OUTPUTS 4-48

4.15 RECOMMENDED SPARE PARTS 4-49

4.16 UPGRADE PROCEDURES 4-49

4.16.1 Base Operating System 4-49

4.16.2 Applications 4-49

RECOMMENDED SPARE PARTS

5.1 ANALYZER SPARES 5-2

5.1.1 Printed Circuit Card Assemblies (Analyzer) 5-2

5.1.2 Electrical and Mechanical Assemblies (Analyzer) 5-2

APPENDIX A, COMMUNICATIONS SPECIFICATIONS

A.1 TCD SERIAL COMMUNICATIONS A-1

A.1.1 Model 1000A with TCD Communications Ports A-2

A.2 FID SERIAL COMMUNICATIONS A-5

A.2.1 Connecting Serial Communications to the GC .. A-8

A.2.2 FTB Serial Communications A-10

A.3 WIRING LOCAL RS-232 COMMUNICATIONS .. A-21

A.3.1 GC Serial Port and Cable Configurations A-21

A.3.2 GC DB 9-pin Serial Port to PC DB 9-pin Port ... A-24

A.3.3 GC DB 9-pin Serial Port to PC DB 25-pin Port . A-25

A.3.4 GC PHOENIX Plug Port to PC DB 9-pin Port A-26

A.3.5 GC PHOENIX Plug Port to PC DB 25-pin Port .. A-27

A.4 WIRING REMOTE RS-232 COMMUNICATIONS A-28

A.4.1 GC DB 9-pin Serial Port to Modem DB 25-pin Port A-28

A.4.2 GC PHOENIX Plug to Modem DB 25-pin Port .. A-29

A.5 EXAMPLE RS-422 PC-GC CONNECTION A-30

A.6 EXAMPLE RS-485 PC-GC CONNECTION A-32

APPENDIX B, MODEM INSTALLATION

B.1 OPTIONAL INTERNAL MODEM B-1

B.1.1 Optional Ethernet Board B-3

APPENDIX C, MANIFOLD CARRIER FOR GAS BOTTLES

C.1 CARRIER GAS C-1

C.2 INSTALLATION AND LINE PURGING C-2

C.3 REPLACING CARRIER CYLINDER C-3

C.4 CALIBRATION GAS C-3

APPENDIX D, LOCAL OPERATOR INTERFACE

D.1 INTERFACE COMPONENTS FOR DISPLAYING AND ENTERING DATA D-1

D.1.1 Light Emitting Diode Indicators D-1

D.1.2 LCD Screen D-2

D.1.3 Keypad D-2

D.1.4 Security Switch D-2

D.2 USING THE LOCAL OPERATOR INTERFACE D-3

D.2.1 Navigating the Screen D-4

D.2.2 Editing Numeric Data D-4

D.2.3 Editing Non-Numeric Data D-5

D.3 NAVIGATING THE LOI MENUS D-7

D.3.1 The Ctrl Menu D-9

D.3.2 The App Menu D-14

D.3.3 The Chrom Menu D-23

D.3.4 The Logs Menu D-29

D.3.5 The Manage Menu D-37

APPENDIX E, ENGINEERING DRAWINGS

E.1 LIST OF ENGINEERING DRAWINGS E-1

DESCRIPTION

1.1 PURPOSE OF THIS MANUAL

The Emerson Process Management *Model 1000A Gas Chromatograph System Hardware Reference Manual* (P/N 3-9000-750) is intended as a user's guide to accompany the MODEL 1000A GAS CHROMATOGRAPH SYSTEM.

NOTE: For software operation instructions, see the *MON2000 Software for Gas Chromatographs User Manual* (P/N 3-9000-522).

This manual provides the following information:

- A general description of the Model 1000A Gas Chromatograph (GC) System and its components, their configurations and functions. (Section 1: Description)
- A brief description of the GC System's software, user interfaces, and capabilities. (Section 1: Description)
- Introduction to GC theory of operation and terminology. (Section 1: Description)
- Guidelines for sampling system and gas connections. (Section 2: Equipment Description)
- Descriptions of Analyzer subsystems and components. (Section 2: Equipment Description)
- Descriptions of GC Controller subsystems and components. (Section 2: Equipment Description)
- Instructions for installing the GC System hardware. (Section 3: Installation and Startup)
- Instructions for regular maintenance and care of the GC System hardware. (Section 4: Maintenance)
- Instructions for troubleshooting, repair, and service of the GC System hardware. (Section 4: Maintenance)
- List of boards, valves, and other components suggested as spare parts. (Section 5: Recommended Spare Parts)

- Appendices with additional, helpful reference materials and drawings. (Appendices)

1.2 INTRODUCTION

The Emerson Process Management Model 1000A Gas Chromatograph is a high-speed GC system that is factory engineered to meet specific field application requirements based on stream composition and the anticipated concentration of the components of interest. The GC system typically consists of two major components, the Analyzer Assembly and the Sample Conditioning System:

- **Analyzer Assembly (Model 1000A Series)**

  Located near the sample tap in a freeze-protected shelter. The Analyzer includes columns, detectors, preamplifier, stream switching valves, solenoids, and the GC, which includes electronics and ports for signal processing, instrument control, data storage, personal computer (PC) interface, and telecommunications.

- **Sample Conditioning System (SCS)**

  Located between the process stream and the Analyzer sample inlet, usually mounted on the lower portion of the Analyzer stand. The standard configuration SCS includes a mounting plate, block (or shutoff) valves, and filters. Optionally, the SCS can be configured with Genie® bypass filters, liquid shut-off valves, and optional solenoids for stream switching; all of which can be enclosed in an electric (heat tape design) oven.

In its standard configuration, the Model 1000A series Analyzer can handle up to five streams: typically, four for sample and one for calibration. With an optional stream switch assembly added, the GC can switch up to twelve streams, maximum.

Although the GC is designed to be operated primarily from the LOI, you can also use a personal computer (PC) running MON2000. The PC option provides the user with the greatest capability, ease-of-use, and flexibility. One PC running MON2000 can connect with up to 32 chromatographs (via RS-485 serial communications links). The PC is used to display analysis chromatograms and reports, which can then be stored to files on the PC hard drive, or printed from either the PC's printer port or the GC's printer port.

Since neither the PC nor a normal printer can be placed in a hazardous area, serial port and Modbus communications links are provided for connecting the GC to the PC, other computers, printers, and controllers.

1.3 FUNCTIONAL DESCRIPTION

A functional block diagram of a typical GC installation is shown in Figure 1-1. A sample of the gas to be analyzed is taken from the process stream by a sample probe installed in the process line. The sample passes through a sample line to the sample conditioning system where it is filtered or otherwise conditioned. After conditioning, the sample flows to the Analyzer for separation and detection of the components of the gas.

The chromatographic separation of the sample gas into its components is accomplished in the Analyzer in the following manner. A precise volume of sample gas is injected into one of the unit's analytical columns. The column contains a stationary phase (packing) that is either an active solid (adsorption partitioning) or an inert solid support that is coated with a liquid phase (absorption partitioning). The gas sample is moved through the column by means of a mobile phase (carrier gas). Selective retardation of the components of the sample takes place in the column that causes each component to move through the column at a different rate. This action separates the sample into its constituent components.

A detector located at the outlet of the analytical column senses the elution of components from the column and produces electrical outputs proportional to the concentration of each component. Outputs from the Analyzer detectors are amplified in the Analyzer electronics, then transmitted to the GC for further processing. See Section 1.6 for more information.

Although output from the GC is normally displayed on the LOI, it can also be displayed on a remotely located personal computer or a printer. Connection between the GC and the PC can be accomplished via a direct serial line or via the Modbus-compatible communication interface.

Multiple chromatograms may be displayed on the LOI and compared or contrasted with separate color schemes. This allows a stored chromatogram to be compared/contrasted with a current or another stored chromatogram. This could be of great assistance when changing parameters or isolating a problem.

In most instances, it is essential to use a PC for detailed troubleshooting procedures. Basic operations should be performed from the LOI that is built into the Model 1000A. With optional electronic boards, the PC can be connected remotely via ethernet, telephone, radio or satellite. Once installed and configured, the GC can operate independently for long periods of time.

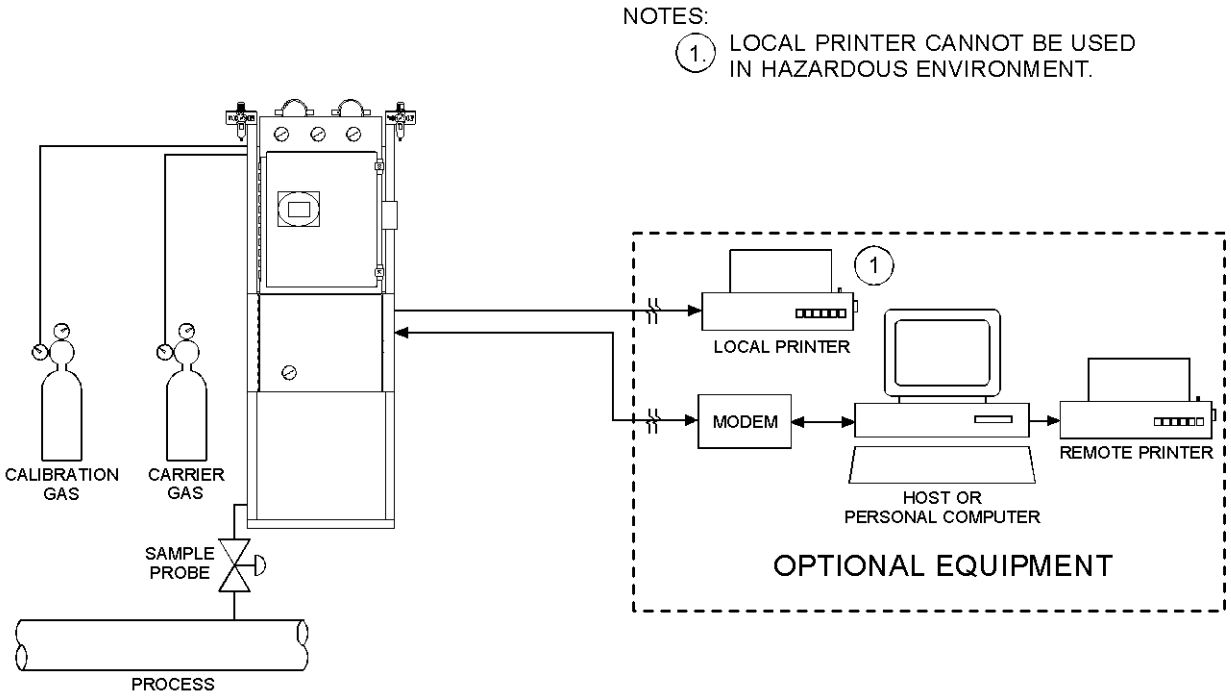

Figure 1-1 GC System Functional Block Diagram

1.4 MINIMUM PC REQUIREMENTS

To achieve maximum performance when running the MON2000 software, ensure your PC system contains the following hardware and software equipment.

- PC with a 486/90 MHz or higher processor (Pentium/100MHz or higher recommended) running:
  - Windows® 95 (service pack 1 or better) or later

NOTE: If running Windows® 95 with the optional ethernet card, the user must download Socket 2 from www.microsoft.com/windows95/ downloads to utilize MON2000's ethernet feature.

  - Windows® 98 version 1 or later
  - Windows® 2000 version 1 or later
  - Windows® XP version 1 or later (see note for system requirements)
  - Windows® Vista version 1 or later

NOTE: <u>You must have administrator privileges to intall MON2000</u> because Vista will not allow a 'standard' user to install software. Even with administrator privileges, you will be prompted by Vista's User Account Control feature to allow or cancel the installation. For more details, refer to Getting Started with User Account Control on Windows Vista (http://go.microsoft.com/fwlink/?LinkID=102562).

  - Windows® NT version 4 (service pack 3 or later)
- 16 MB of RAM (32 MB or higher recommended)
- 5 MB of free hard disk space
- Super VGA monitor with 800x600 resolution
- Free serial port for remote/local connection to gas chromatograph (for online operations)
- Free parallel port for connection to printer
- Windows®-compatible modem (for remote connection only)

NOTE: Microsoft Internet Explorer 5.0 is required to view spreadsheets or reports saved in HTML format.

- Use the *Settings* → *Control Panel* → *System* → *General Page* menu path to check the system version number.
  - For Windows® 95, the version number should be 4.00.950A/B or later.
  - For Windows® 98 or Windows® 2000, the version number should be 1 or later.
  - To use Windows® XP you need a PC with 300 MHz or higher processor clock speed recommended; 233 MHz minimum required (single or dual processor system);* Intel® Pentium®/Celeron® family, or AMD K6®/Athlon™/Duron™ family, or compatible processor recommended.
  - Memory 128 MB of RAM or higher recommended (64 MB minimum supported; may limit performance and some features)
  - Hard Disk Minimum: 1.5 GB of available hard disk space
  - For Windows NT4, the version number should be 4.00.1381 or later.

1.5 MODES OF OPERATION

1.5.1 User Interface

You have two user interfaces from which to operate the gas chromatograph (GC) system: the LOI or a PC connected to the GC and running MON2000.

The LOI allows you to gather basic information and to perform maintenance repairs at the GC site.

A PC connected to the GC and running MON2000 offers the greatest amount of capability and flexibility.

Find complete user instructions for MON2000 in the program's online HELP manual as well as in the *MON2000 Software for Gas Chromatographs User Manual* (P/N 3-9000-522).

1.5.2 Capabilities

Some of the individual GC controller functions that can be initiated or controlled by the GC and its software, MON2000, include the following:

- Valve activations
- Timing adjustments
- Stream sequences
- Heater controls (when applicable)
- Calibrations
- Baseline runs
- Analyses
- Halt operation
- Stream/detector assignments
- Stream/component table assignments
- Stream/calculation assignments
- Diagnostics
- Alarm and event processing
- Event sequence changes
- Component table adjustments
- Calculation adjustments
- Alarm parameters adjustments
- Analog scale adjustments

Some of the reports and logs that can be produced, depending upon the GC application in use, include the following:

- Configuration report
- Parameter list
- Analysis chromatogram
- Chromatogram comparison

- Alarm log (unacknowledged and active)
- Event log
- Analysis raw data

1.6 THEORY OF OPERATION

NOTE: See Section 1.7 for definitions of some of the terminology used in the following explanations.

1.6.1 Analyzer Detector

The Analyzer detector subsystem is a thermal conductivity detector that consists of a balanced bridge network with heat-sensitive thermistors in each leg of the bridge. Each thermistor is enclosed in a separate chamber of the detector block. One thermistor is designated the reference element and the other the measurement element. A schematic diagram of the thermal conductivity detector is shown in Figure 1-2.

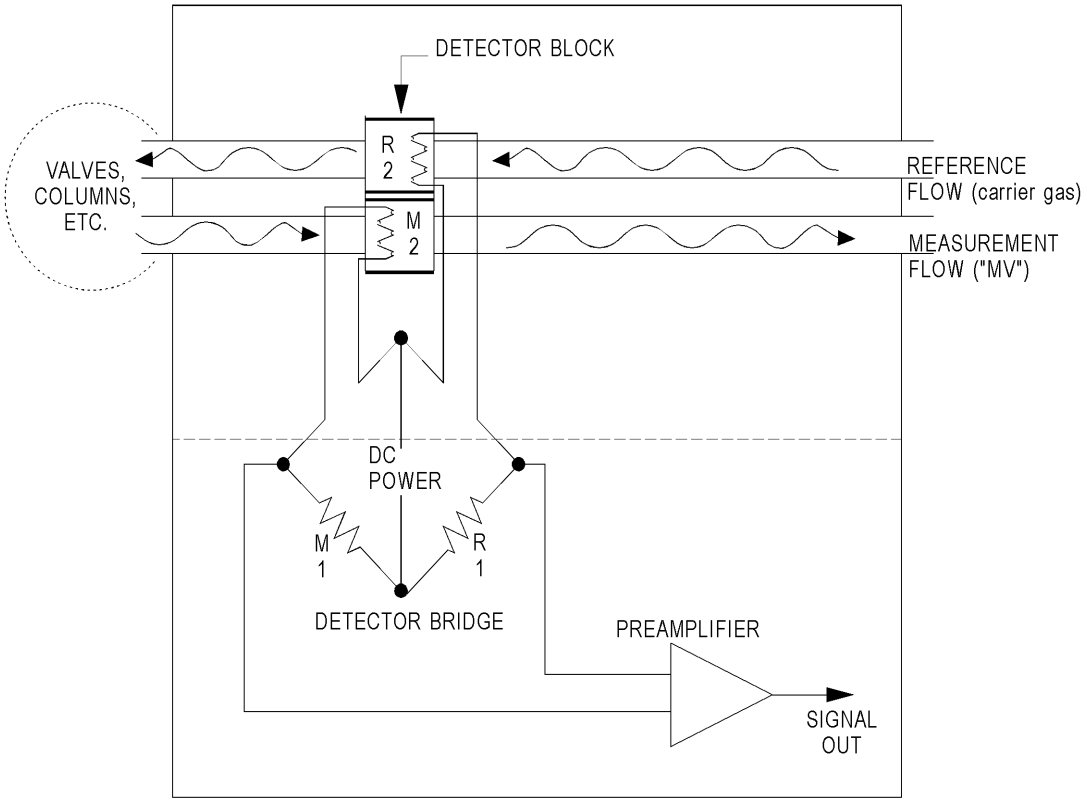

Figure 1-2 Schematic Diagram of Analyzer Detector Bridge

In the quiescent condition (prior to injecting a sample), both legs of the bridge are exposed to pure carrier gas. In this condition, the bridge is balanced and the bridge output is electrically nulled. The bridge can be balanced by the fine and coarse adjustment potentiometers located on the preamplifier circuit board.

The analysis begins when a fixed volume of sample is injected into the column by operation of the sample valve. The sample is moved through the column by the continuous flow of carrier gas. As successive components elute from the column, the temperature of the measurement element changes. The temperature change unbalances the bridge and produces an electrical output proportional to the component concentration. The differential signal developed between the two thermistors is amplified by the preamplifier.

Figure 1-3 illustrates the change in detector electrical output during elution of a component.

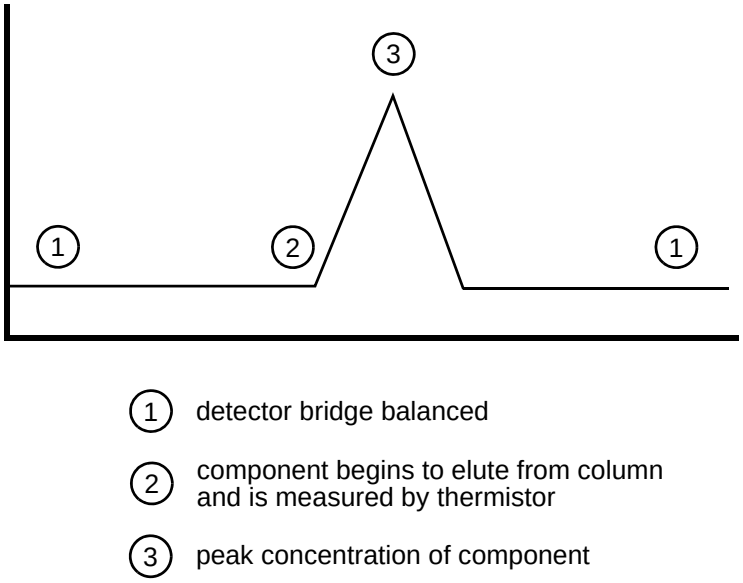

Figure 1-3 Detector output during component elution

In addition to amplifying the differential signal developed between the detector's two thermistors, the preamplifier also supplies drive current to the detector bridge. The preamplifier also supplies drive current to the detector bridge. The voltage signal is converted to a 4 to 20-milliamp (mA) current loop for transmission to the GC Controller.

The signal is proportional to the concentration of a component detected in the gas sample. The preamplifier provides four different gain channels as well as compensation for baseline drift.

The signals from the preamplifier are sent to the GC Controller for computation, recording on a printer, or viewing on a PC monitor or LOI.

1.6.2 Data Acquisition

Every second, exactly 40 equi-spaced data samples are taken for analysis by the GC (i.e., once every 25 milliseconds). Each data sample, after having been precision-amplified, is subjected to a twelve bit analog to digital (A/D) conversion. The sampling frequency of 40 Hertz (Hz) was chosen to reduce 60 Hz normal mode noise.

After each point on the chromatograph signal is sampled, the resulting number is stored in a buffer area in the GC's memory for processing. During the analysis, only the last 256 data points are available for processing. Because the data analysis is done as the signal is sampled (in real-time), only a limited number of past data samples is required to analyze any signal.

As a part of the data acquisition process, groups of incoming data samples are averaged together before the result is stored to the GC's memory for processing. Non-overlapping groups of N samples are averaged and stored, and thus reduce the effective incoming data rate to $40/N$ samples/second. For example, if N = 5, then a total of 40/5 or 6 (averaged) data samples are stored every second. The value for the variable N is determined by the selection of a Peak Width (PW) parameter. The relationship is:

$$N = PW_{seconds}$$

where *PW* is given in seconds. All the various details in the analysis process are independent of the value of *N*. Allowable values of *N* are 1 to 63, which corresponds to values of *PW* from 2 to 63 seconds.

The variable *N* is known as the integration factor. This term is used because *N* determines how many points are averaged or integrated to form a single value. The integration of data upon input, before storing, serves two purposes. First, the statistical noise on the input signal is reduced by the square root of *N*. In the case of N = 4, a noise reduction of two would be realized. Secondly, the integration factor controls the bandwidth of the chromatograph signal. It is necessary to match the bandwidth of the input signal to that of the analysis algorithms in the GC. This prevents small, short duration perturbations from being recognized as true peaks by the program. It is therefore important to choose a Peak Width corresponding to the narrowest peak in a group under consideration.

1.6.3 Peak Detection

For normal area or peak height concentration evaluation, the determination of a peak's start, peak point, and end is automatic. The manual determination of start and end points is used only for area calculations in the Forced Integration mode. Automatic determination of peak onset or start is initiated whenever Integrate Inhibit is turned off. Analysis is started in a region of signal quiescence and stability, such that the signal level and activity can be considered as baseline values. It is important that this be the case because the assumption is made by the GC software.

Having initiated a peak search by turning Inhibit off, the GC performs a point by point examination of the signal slope. This is achieved by using a digital slope detection filter which is a combination low pass filter and differentiator. The output of this detector is constantly compared to a system constant entered by the operator called Slope Sensitivity. A default value of 8 is assumed if no entry is made. Lower values make peak onset detection more sensitive, and higher values make detection less sensitive. Higher values (20 to 100) would be appropriate for noisy signals, e.g. high amplifier gain.

Peak termination is determined by the same application of this detector to the signal, but in the reverse sense. Onset is defined where the

detector output exceeds the baseline constant, but termination is defined subsequently where the detector output is less than the same constant.

Sequences of fused peaks are also automatically handled. This is done by testing each termination point to see if the region immediately following it satisfies the criteria of a baseline. A baseline region must have a slope detector value less than the magnitude of the baseline constant for a number of sequential points. When a baseline region is found, this terminates a sequence of peaks.

A zero reference line for peak height and area determination is established by extending a line from the point of the onset of the peak sequence to the point of the termination. The values of these two points are found by averaging the four integrated points just prior to the onset point and just after the termination points, respectively. The zero reference line will, in general, be non-horizontal, and thus compensates for any linear drift in the system from the time the peak sequence starts until it ends.

In a single peak situation, peak area is the area of the component peak between the curve and the zero reference line. The peak height is the distance from the zero reference line to the maximum point on the component curve. The value and location of the maximum point is determined from quadratic interpolation through the three highest points at the peak of the discrete valued curve stored in the GC.

For fused peak sequences, this interpolation technique is used both for peaks as well as valleys (minimum points). In the latter case, lines are dropped from the interpolated valley points to the zero reference line to partition the fused peak areas into individual peaks. The use of quadratic interpolation improves both area and height calculation accuracy and eliminates the effects of variations in the integration factor on these calculations.

For calibration, the GC may average several analyses of the calibration stream.

1.6.4 Basic Analysis Computations

Two basic analysis algorithms are included in the GC. These are:

- Area Analysis - Calculates area under component peak
- Peak Height Analysis - Measures height of component peak

Concentration Analysis by Using Response Factor

Concentration calculations require a unique response factor foreach component in an analysis. These response factors may be manually entered by an operator or determined automatically by the system through calibration procedures (with a calibration gas mixture that has known concentrations).

Response factor calculation: (using the external standard)

$$ARF_n = \frac{Area_n}{Cal_n}$$

or

$$HRF_n = \frac{Ht_n}{Cal_n}$$

where:

ARF_n Area response factor for component n in area per mole percent (%).

HRF_n Height response factor for component n.

$Area_n$ Area associated with component n in calibration gas.

Ht_n Height associated with component n in mole percent in calibration gas.

Cal_n Amount of component n in mole percent in calibration gas.

Calculated response factors are stored by the GC for use in the concentration calculations, and are printed out in the configuration and calibration reports.

Average response factor is calculated as follows:

$$RFAVG_n = \frac{\sum_{i=1}^{k} RF_i}{k}$$

where:

$RFAVG_n$	Area or height average response factor for component n.
Rf_i	Area or height response factor for component n from the calibration run.
k	Number of calibration runs actually used to calculate the response factors.

The percent deviation of new RF averages from old RF average is calculated in the following manner:

$$\% \text{ deviation} = \left[\frac{RF_{new} \angle RF_{old}}{RF_{old}} \times 100\right]$$

where the absolute value of *% deviation* for alarm has been previously entered by the operator.

Concentration Calculations in Mole % without Normalization

Once response factors have been determined by the GC or entered by the operator, component concentrations are determined for each analysis by using the following equations:

$$CONC_n = \frac{Area_n}{ARF_n}$$

or

$$CONC_n = \frac{Ht_n}{HRF_n}$$

where:

$CONC_n$	Concentration of component n in mole percent.
$Area_n$	Area of component n in unknown sample
ARF_n	Response factor of component n calculated from area of calibration sample. Units are area per mole percent.
Ht_n	Peak height of component n in unknown sample
HRF_n	Response factor of component n calculated from peak height of calibration sample. Units are height per mole percent.

Note that the average concentration of each component will also be calculated when data averaging is requested.

Component concentrations may be input through analog inputs 1 - 4 or may be fixed. If a fixed value is used, the calibration for that component is the mole % that will be used for all analyses.

Concentration Calculations with Normalization

$$CONCN_n = \frac{CONC_n}{\sum_{i=1}^{k} CONC_i} \times 100$$

where:

$CONCN_n$	Normalized concentration of component n in percent of total gas concentration.
$CONC_n$	Non-normalized concentration of component n in mole percent.
$CONC_i$	Non-normalized concentration (in mole percent) from each of the k components to be grouped into this normalization.
k	Number of components to be included in the normalization.

NOTE: For additional information about other calculations that are performed by the GC and software, see the *MON2000 Software for Gas Chromatographs User Manual* (P/N 3-9000-522).

1.7 GLOSSARY

Auto Zero: Automatic zeroing of the preamplifier. May be entered into the Controller to take place at any time during the analysis when either the component is not eluting or the baseline is steady.

Chromatogram: A permanent record of the detector output. A chromatograph is obtained from the LOI or from a PC interfaced with the detector output through the GC. A typical chromatogram displays all component peaks, and gain changes. It may be viewed in color as it is processed on the LOI or a PC VGA display. Tick marks recorded on the chromatogram by the GC indicate where timed events take place.

Component: Any one of several different gases that may appear in a sample mixture. For example, natural gas usually contains the following components: nitrogen, carbon dioxide, methane, ethane, propane, isobutane, normal butane, isopentane, normal pentane, and hexanes plus.

Condulet: Fitting resembling a pipe or a box with a removable cover for access to electric conduits.

CTS: Clear to send (a serial port pin assignment).

DCD: Data carrier detect; see also, RLSD (a serial port pin assignment).

DSR: Data set ready (a serial port pin assignment).

DTR: Data terminal ready (a serial port pin assignment).

LOI: Local operator interface; an integrated color display panel with infrared touchkeys that allows you to interact with the GC.

Response Factor: Correction factor for each component as determined by the calibration. See "Concentration Analysis by Using Response Factor" on page 13 for more information.

Retention Time: The time (in seconds) that elapses between start of analysis (0 seconds) and the sensing of the maximum concentration of each component by the Analyzer detector.

RI: Ring indicator (a serial port pin assignment).

RLSD: Received line signal detect (a digital simulation of carrier detect); see also, DCD (a serial port pin assignment).

RTS: Request to send (a serial port pin assignment).

RxD, RD, or S_{IN}: Receive data, or signal in (a serial port pin assignment).

TxD, TD, or S_{OUT}: Transmit data, or signal out (a serial port pin assignment).

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EQUIPMENT DESCRIPTION

This section provides descriptions of the various subsystems and components that make up the Model 1000A Gas Chromatograph (GC) system.

2.1 SAMPLING SYSTEM

A well designed, properly adjusted sampling system is essential to optimum performance of any gas chromatograph. If a good sample is not obtained for analysis, the whole purpose of the system is compromised.

The purpose of the sample handling system is to transfer a conditioned fluid sample that is compatible with gas chromatography requirements.

The Sample Conditioning System (SCS) is located between the process stream and the Analyzer, and is usually mounted on the lower portion of the Analyzer stand. It serves these purposes:

- Extracts final sample from the fast loop,
- Performs final filtration,
- Performs stream switching for a multi-stream Analyzer, and
- Adjusts the final pressure, temperature, and flow control on the selected sample flowing to the sample valve.

The following points should be considered in selecting and installing a sampling system:

- Sample Point
- Sample Volume and Flow Rate
- Sample Conditioning
- Contamination Precautions
- Valving
- Calibration Gas

2.1.1 Sampling Point Location

Gas samples must be representative of the process stream and must be taken from a location where stratification or separation of components does not occur. The sampling point should be as close as feasible to the Analyzer.

2.1.2 Sample Volume and Flow Rate

An adequate response time for sample analysis requires that sample volumes should generally be as small as possible, and the flow rate between the sampling point and the Analyzer should be as high as possible, consistent with accuracy. To minimize time lag and to prevent back diffusion, dryers and filters in the sampling line should be as small as possible. When long sampling lines cannot be avoided, flow velocity in the line can be increased by decreasing the downstream pressure.

Typically, pressure is reduced at the sample point with a pressure regulating sample probe. The input pressure to the Analyzer can be adjusted between 15 and 30 pounds per square inch, gauge (psig). Reducing the pressure at the sample point avoids the problem of heavy liquid dropout in the sample line during cold weather. The flow rate in the sample line is set at 50 cubic centimeters (cc) per minute with the restrictor valve at the Analyzer.

The Model 1000A is capable of accepting liquid phase samples also. In this case, the pressure is regulated by means of a back pressure regulator located on the SCS mounting plate. If the stream is at ambient pressure or under slight vacuum, an educator or pump may be used to force sample through the sample loop. In this situation, sample shut-off technique with equalizing coil is employed to ensure consistency of the sample volume.

Use this general rule to approximate sample lag time caused by the length of sample line:

$$\text{lag time} = \frac{\text{length of sample tubing}}{\text{flow rate of sample}}$$

Sample line constructed of 1/8-inch tubing contains approximately one cubic centimeter of volume per foot. Therefore, with a flow rate of 50 cubic centimeters per minute, the lag time of the sample between the sample point and the Analyzer is calculated by dividing the length of the line (in feet) by 50. For example, the sample in a 100 foot sample line will take two minutes to travel the length of the line.

2.1.3 Sample Conditioning

Sample systems should contain at least one filter to remove solid particles from the sample stream. Most applications require fine-element filters upstream of the Analyzer.

2.1.4 Contamination Precautions

Several precautions are recommended to minimize the possibility of contaminating samples. Except in special applications, filters should be of either the ceramic or the porous metallic type to avoid the absorption losses characteristic of fiber or paper filters. Pressure regulators and flow controllers containing cork or felt filters or absorbent diaphragms should not be used. Sampling lines for noncorrosive streams should be stainless steel tubing and must be clean and free of grease. Lines must be pressure tight to prevent diffusion of moisture or atmospheric gases into the sample. Pipe threads should be dressed only with Teflon tape on pipe threads and never with pipe thread compounds (dope).

2.1.5 Valving

A block valve should be installed immediately downstream of the sample takeoff point to permit shutdown of the system for maintenance. Block valves should be either gate valves or cocks of the proper material and packing, and should be rated for the process line pressure. Tight seating of all connections is essential.

2.1.6 Calibration Gas

A calibration gas used for Process analysis should be blended to Primary Standards. Primary Standards are blended using weights that are traceable to the National Bureau of Standards (NBS). If the calibration standard is a gas, the standard should not have any component that could drop out at the coldest temperature to which the gas will be subjected.

If a liquid calibration standard is being used, the head pressure must be sufficient to prevent bubble-out of components during hot weather.

2.2 ANALYZER

2.2.1 Physical Description

The Analyzer is physically divided into two major sections. The upper section contains the following components:

- Pneumatically actuated valves that control the flow of the sample and carrier gases
- Valve control
- Heater-block temperature control
- Detector control
- Detector output signal preamplifier
- GC Controller

The lower section is temperature controlled and contains:

- Detector elements
  - TCDs
  - FIDs
  - Both
- Analytical columns
- Chromatograph valves
- A temperature-controlled heater block

The GC is mounted in a self-supporting rack that should be placed at or near the sample tap. At a minimum, a three-sided shelter is recommended.

2.2.2 Chromatograph Valves

A chromatograph valve is shown in Figure 2-1 in exploded view. Its pistons are pneumatically actuated in both switching directions by the actuating assemblies located below the primary plate.

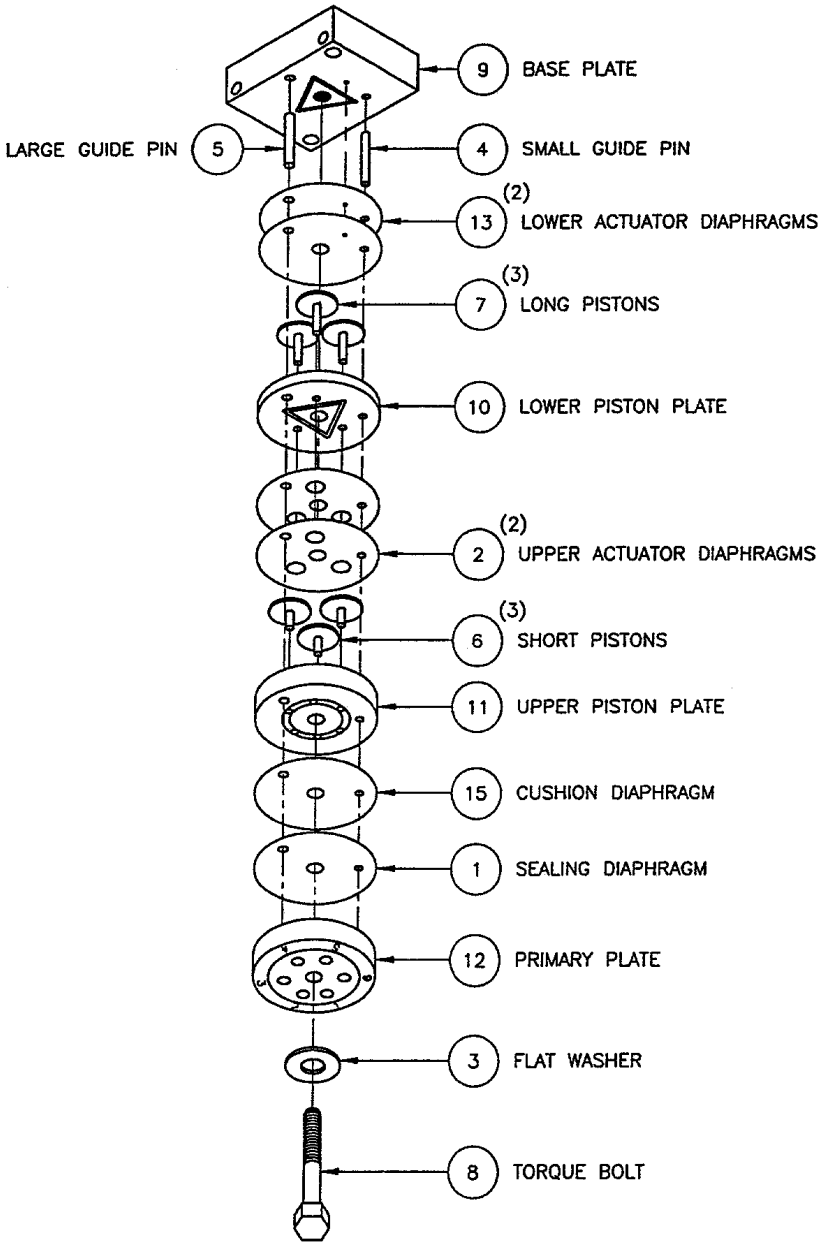

Figure 2-1 Chromatograph Valve

Primary Plate

The primary plate contains precisely machined internal passages that enter and exit the valve at top ports, each of which is connected to the top and/or bottom of the plate within the valve. The primary plate, which is the only metallic element that comes in contact with the sample, is isolated from the remainder of the valve by specially formulated diaphragms.

NOTE: GC valves should be torqued to 30 ft. lbs.

Actuating Subassemblies

Below the primary plate, pistons are operated by pneumatic pressure applied to actuating diaphragms through ports in the base plate.

Operation

When pneumatic pressure is applied to the actuating diaphragms, the pistons are actuated, thus forcing the sealing diaphragm against the primary plate. This closes the passages that are connected at the bottom of the plate. When pressure is removed, the pistons are free to move, and flow is resumed through the passages.

2.2.3 Detector Subsystem

The operation of the Analyzer detector subsystem was previously discussed in "THEORY OF OPERATION," Section 1.6.

2.2.4 Analyzer Preamplifier Unit

The electrical output from the detector is amplified by the Analyzer preamplifier unit. The preamplifier also supplies drive current to the detector bridge. The voltage signal is converted to a 4 to 20-milliamp (mA) current loop for transmission to the GC. The signal is proportional to the concentration of a component detected in the gas sample. The preamplifier provides four different gain channels and compensates for baseline drift. The signals from the preamplifier are then sent to the GC, where they provide the basis for analysis computations and a chromatographic trace, or chromatogram.

2.2.5 Analyzer Specifications

Power Requirements: 120 volts, alternating current (VAC), +10/ -15VAC; 50 to 60 Hertz (Hz); single phase; 10 amperes (A) (maximum during warmup) (additional 10 amps if unit has a Sample System Oven).

Operating Temperature Range: -18 degrees Celsius (°C) to +55°C (0°F to +130°F)

Humidity: 0 to 95 percent relative humidity, noncondensing

Frame Size (approximately):

- Height:78 inches (198 centimeters [cm])
- Width:24 inches (61 cm) maximum
- Depth:24 inches (61 cm)

Weight: Approximately 125 pounds (56.8 kilograms [kg]), including mounting hardware.

Sample Requirements:

- Fluid Phase - Vapor
- Pressure - 15 to 30 psig, regulated to ±10 percent
- Flow Rate - 50 cc/min, typical

Analyzer Output Signal: Four different gain channels to provide a 4 to 20 mA signal to the Controller.

Transient Over Voltages Category: Installation Category (Over Voltage Category II)

Cleaning requirements: For external cleaning, use detergent and water, as well as a non-abrasive drying material. For internal maintenance of the analytical valves, refer to "Valve Cleaning," Section 4.8.3.

2.2.6 Utility Gas Requirements

Carrier Gas: Application dependent; typically zero grade helium, hydrogen or nitrogen (99.995% pure, with less than 5 ppm water, and less than 0.5 ppm hydrocarbons); pressure is variable.

Valve Actuation Gas: Zero grade, 99.995% pure helium at 100 psig. Consumption is 100cc per analysis cycle. Clean, dry air also may be used for valve actuation.

Carrier gas and valve actuation gas are normally supplied from a common cylinder, since overall gas consumption is minimal.

2.3 ELECTRONIC ASSEMBLY

The electronic assembly provides the GC with highly accurate timing, precise calculations, report generation, and an interface with other devices. The assembly provides analog outputs and a direct digital link with output devices through RS-232C, RS-422, and RS-485 ports. Vital portions of the controller are protected by a lithium battery backup in case normal power is lost or turned off at the unit.

The GC controller can be linked directly to a PC by a serial connection, by a telecommunication link that uses Modbus protocol, or by an ethernet connection, which is the preferred method for operating the GC.

WARNING: SERIOUS INJURY OR DEATH POSSIBLE
Do not operate a PC or printer in a hazardous environment. Failure to observe all safety precautions could result in serious injury or death.

2.3.1 Controller Hardware Configurations

The unit consists of an STD-bus based computer and related boards, including boards for terminating field wiring. Connections to the enclosure are through one 2-inch (50mm) hole (reduced to 3/4 inch with bushing) and two 1-inch (25 mm) conduit fittings located in the bottom. These accept matching conduit or cable entries. Field connections are made through purged conduit or flameproof glands.

For operating a printer (in a nonhazardous area) at the GC site, a DB-25 parallel port is available on the GC's Terminal Board (TB) for field wiring.

The electronic assembly contains a DB-9 serial port connector for connecting a PC to the GC at the GC site (for setup, operation, or maintenance in a nonhazardous area).

The STD-Bus Card Cage inside the electronics enclosure is equipped with two cards. Card slots are preassigned so that cables can be consistently routed.

Three optional boards are also available, any two of which can be piggy-backed on the CPU board. The optional boards are: the COM4A board, the modem board, and the ethernet board. If the Radicom modem is used, it must be the top board in the card cage assembly.

An optional stream switching assembly (with either AC or DC solenoids) can be controlled by the GC, allowing for switching up to 12 streams.

Analog Inputs and Outputs

The GC can accommodate eight fully differential analog 4 to 20 mA input signals. Four of the analog inputs are used by the associated Analyzer, and they are filtered with transient protection. The additional four input ports provide the ability to accept signals from other Analyzers, so that the analytical report of the chromatograph can include other information on the gas stream, such as water or sulphur content. Transient protection and shield terminations are available for these inputs.

There is capability for a maximum of twelve analog outputs. Four analog outputs are available as standard components of the GC; the other eight analog outputs are optional. All twelve analog outputs are current type: 4-20 mA, not isolated. If required, the standard four analog outputs can be isolated and an optional board can be purchased with an additional four isolated outputs, for a total of eight isolated analog outputs. Also, all twelve analog outputs can be calibrated with MON2000.

Digital Inputs and Outputs

The GC has up to 16 digital inputs that can be used as follows:

5 to read a Modbus address, as defined by DIP switch positions.

2 to indicate presence and type of front panel as defined by switch positions

1 Spare

1 temperature sensor input to shut off LCD backlight

1 GC alarm, optically isolated, with transient protection

5 stream flow alarms, optically isolated, with transient protection

1 photocell detector, front panel backlight (night on, day off)

The Controller has the capability of 19 digital outputs used as follows:

6 Analyzer control

8 driver outputs for DC air solenoids (stream switching, 12 total streams)

5 alarms, optically isolated, with transient protection

The digital transient-protected discrete outputs can furnish up to 50 mA. If more current is required (up to 0.5A), a special transient protection plug-in module should be installed. See Appendix C for transient protection module details.

Communications

There are three to six communication ports available (depending on options package selected). The communications ports can use either RS-232, RS-422, or RS-485 protocol, selected by Data Interface Chips via the CPU Board. The communications ports on these boards are normally configured at the factory, as specified by the customer's communications requirements. The Modbus switch positions are also normally set at the factory as specified by the customer. If any changes need to be made in the field, refer to the drawings in the rear of this manual.

Driver Outputs

The GC Controller has eight stream switch outputs, 120 mA continuous current, which can be used to control optional AC or DC solenoid switch

boards. This increases stream switch capability from the standard capability of four gas streams and 1 calibration gas (CAL) system to a maximum capability of twelve streams.

NOTE: The optional stream switching assembly (AC or DC solenoid systems) has provisions for eight stream routes, but adding this option has the net effect of adding only seven more stream routes to the standard stream capacity of five (thus giving a total stream capacity of twelve). The reason is, when the optional stream switch assembly is installed, one of the Analyzer's standard five stream routes becomes dedicated to the optional stream switch assembly.

Electrical/Mechanical Safety and Integrity - Certifications and Classifications

The standard Model 1000A is approved for use in a non-hazardous or general purpose location. If an optional Z-purge kit is purchased and added to the Model 1000A, the unit is CSA-certified for a Class I, Division 2, Groups B, C and D area. The Temperature Code for both the standard Model 1000A, and the Model 1000A with an optional Z-purge kit, is T3.

GC Controller Circuit Board List

The GC circuit boards are inserted or attached to an STD-bus card cage assembly. It has two boards inserted into the card cage, and two of the boards are attached to the card cage outside.

There are three optional piggy-back boards which can attach to the CPU Board via the PC 104 bus:

- Modem
- COM4A (serial ports 5, 6, 7, and 8)
- Ethernet board

The inserted circuit boards of the GC controller perform these functions:

Table 2-1 Functions of Inserted Circuit Boards, GC Controller Card Cage Assembly

Subsystems	Handle Label or Part Number	Function(s)	See drawing number...
CPU microprocessor board	MCM/LPM-6117	Microprocessor; control of parallel printer port; control of COM1, COM2, COM3, and COM4 communication ports; system memory; RS-422 serial protocol; three timers, digital I/O, and Disk on Chip. Additional memory for higher capacity data archives.	DE-20782
COM4A Board (CPU daughter board)		Control of COM5-8	BE-20767
Modem (CPU Daughter board)		telephone modem	
Analog I/O board [requires MON2000, version 2.3 or later]	Analog*	Control of eight analog inputs (4 for user applications and 4 for Analyzer-Controller interconnect) and two, six, or ten analog outputs	BE-18044
Ethernet Card (CPU daughter board)	PCM-NE 2000	Flexible, high-performance networking capability; broad spectrum of software support (from Windows® 95 to Netware 2000 architecture)	

There are two circuit boards attached to the outside of the card cage:

- The System Interface and Driver Board
- The GC's Terminal Board for Field Wiring

The GC's Terminal Board for Field Wiring provides termination connections for the following items:

- Communication ports (COM1, COM2, COM3, COM4, COM5, COM6, COM7, and COM8)
- Analog inputs and outputs

- Digital inputs and outputs
- Controller-Analyzer interconnections
- Parallel printer port
- Optional stream switching assemblies

NOTE: See drawing DE-20782 for an illustration of the GC Controller's Terminal Board for Field Wiring.

The GC Controller's Terminal Board for Field Wiring also has sockets for transient protection modules, and a 250 VAC, 2A fuse (5 x 20 mm) that protects all of the boards from transient surges.

NOTE: See Appendix C and drawing CE-18115 for a list of transient suppression modules that are installed for various configurations of the GC and its communication, analog output, and stream-switching options.

The System Interface and Driver Board provides the following functions:

- Drivers for switching the eight optional valve solenoids
- Location for 8-position DIP switch to set the Modbus address
- Opto-isolation circuits for the discrete inputs and outputs
- Switching power supply and temperature shutdown circuit for the LCD display
- RS-232 to RS-422 conversion for the LCD display
- Voltage-to-current conversion for the analog outputs
- Jumper for selecting driving voltage source for the 4-20 mA circuit

NOTE: See drawing CE-18118 for an illustration of the System Interface and Driver board.

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INSTALLATION AND SETUP

This section provides instructions for installing and setting up the Model 1000A Gas Chromatograph system.

NOTE: Because the Model 1000A Gas Chromatograph system is available in different configurations, not all of the instructions in this section may apply. In most cases, however, to install and set up a Model 1000A Gas Chromatograph system, it is recommended that you follow the instructions in nearly the same order as presented in this manual. (Also see Table 3-1 for a summary of installation and setup steps.)

Table 3-1 Summary of Installation and Setup Steps

1	Observe Precautions and Warnings See Section 3.1
2	Plan Site Location See Section 3.2
3	Obtain Supplies and Tools See Section 3.2
4	Install Analyzer Wiring See Section 3.3
5	Install Analyzer Sample & Gas Lines See Section 3.3
6	Install GC Controller Wiring See Section 3.4
7	Perform Leak Checks See Section 3.5
8	Purge Carrier Gas Lines See Section 3.5
9	Purge Calibration Lines See Section 3.5
10	Start Up GC System See Section 3.6

3.1 PRECAUTIONS AND WARNINGS

NOTE: The analyzer electronics and oven assembly, when housed inside a purged enclosure, meet the certifications and classifications identified in "Electrical/Mechanical Safety and Integrity - Certifications and Classifications" on page 2-11. Emerson Process Management does not, however, accept any responsibility for installations of these, or any attached equipment, in which the installation or operation thereof has been performed in a manner that is negligent and/or non-compliant with applicable safety requirements.

WARNING: EQUIPMENT DAMAGE OR PERSONAL INJURY
The responsible body shall operate the equipment as designed and specified by the manufacturer. Failure to do so may cause personal injury or damage to the equipment.

3.1.1 Hazardous Environments

1	Observe Precautions and Warnings
2	Plan Site Location
3	Obtain Supplies and Tools
4	Install Analyzer Wiring

Follow these precautions if installing or operating the Model 1000A Analyzer instrumentation in a *hazardous area*:

1. Install and operate only the purged version of the Model 1000A in a hazardous area.
2. Do not operate any printer or personal computer (PC) that is connected to the GC in a hazardous area. To interface with a GC in a hazardous area, use the Local Operator Interface (LOI) that is built into the purged housing or, alternatively, use a PC that is remotely connected to the GC and is located in a nonhazardous area.

3. Ensure that field connections to the Analyzer and the GC are made through purged conduit or flameproof glands.

WARNING: EQUIPMENT DAMAGE OR PERSONAL INJURY
Observe ALL applicable regulations when installing purged GC units. Failure to observe all regulations when installing purged GC units may result in noncompliance, equipment damage or personal injury.

The purged analyzer housing is certified for use in locations where fire and explosion hazards may exist, specifically, areas that are classified by the National Electronics Code (NEC) as Class I, Division 2, Groups B, C, and D. However, other regulations do apply. For example, all interconnecting runs of cable through conduit must be sealed at least 18 inches beyond the conduit's point of entry into certified purged housing. Consult your company's policies and procedures and other applicable requirements documents to determine appropriate wiring and installation practices.

3.1.2 Power Source Wiring

1	Observe Precautions and Warnings
2	Plan Site Location
3	Obtain Supplies and Tools
4	Install Analyzer Wiring

Follow these precautions when installing AC power source wiring to the Model 1000A Analyzer instrumentation:

1. All wiring must conform to the National Electric Code, local state or other jurisdiction, and company standards and practices.
2. Provide single-phase, three-wire, AC power at 115 or 230 volts AC, 50-60 Hz.
3. Include a switch or circuit breaker that is marked as the power disconnect device in the building installation in a safe area.

4. Provide 20 ampere circuit breaker protection so that the major components of the GC are protected by one circuit breaker.
5. Use multi-stranded copper conductor wire according to the following recommendations:
   (a) For power feed distances up to 250 feet (76 meters), use wire size American Wire Gauge (AWG) 14 (18 Metric Wire Gauge, stranded).
   (b) For power feed distances 250 feet to 500 feet (76 meters to 152 meters), use wire size AWG 12 (25 Metric Wire Gauge, stranded).
   (c) For power feed distances 500 feet to 1000 feet (152 meters to 305 meters), use wire size AWG 10 (30 Metric Wire Gauge, stranded).

3.1.3 Signal Wiring

1	Observe Precautions and Warnings
2	Plan Site Location
3	Obtain Supplies and Tools
4	Install Analyzer Wiring

Follow these general precautions for field wiring digital and analog input/output (I/O) lines:

1. Metal conduit must be used for all process signal wiring.
2. Metal conduit used for process signal wiring must be grounded at conduit support points (grounding the conduit at multiple points helps prevent induction of magnetic loops between the conduit and cable shielding).
3. Use suitable lubrication for wire pulls in conduit to prevent wire stress.
4. All process signal wiring should be a single, continuous length between field devices and the GC. If, however, length or conduit runs require that multiple wiring pulls be made, the individual conductors must be interconnected with suitable terminal blocks.
5. Use separate conduits for AC voltage and DC voltage circuits.

6. Do not place digital or analog I/O lines in same conduit as AC power circuits.
7. Use only shielded cable for digital I/O line connections.
   (a) Ground the shield at only one end.
   (b) Shield-drain wires must not be more than two AWG sizes smaller than the conductors for the cable.
8. When inductive loads (relay coils) are driven by digital output lines, the inductive transients must be diode clamped directly at the coil.
9. Any auxiliary equipment wired to the GC must have its signal common isolated from earth/chassis ground.

NOTE: Any loop of extra cable left for service purposes inside the GC purged housing must not be placed near the conduit entry for AC power. This applies to all digital and analog I/O lines connecting to the GC.

If the above precaution is not followed, the data and control signals to and from the GC can be adversely affected.

3.1.4 Electrical and Signal Ground

1	Observe Precautions and Warnings
2	Plan Site Location
3	Obtain Supplies and Tools
4	Install Analyzer Wiring

Follow these general precautions for grounding electrical and signal lines:

1. For shielded signal conducting cables, shield-drain wires must not be more than two AWG sizes smaller than the conductors for the cable. Shielding is grounded at only one end.
2. Metal conduit used for process signal wiring must be grounded at conduit support points (intermittent grounding of conduit helps

prevent induction of magnetic loops between the conduit and cable shielding).

3. A clamp type ground lug (color green) is located on the inside bottom front of the GC's electronics enclosure. Chassis ground conductors (color code green) inside the electronics enclosure should be stranded, insulated copper wire. These device chassis ground conductors should all be connected to the clamp type ground lug.
4. A clamp type ground lug is located on the outside of the GC's case at the rear of the lower right (facing the operator panel) casting rib. This ground point should be connected to a copper ground rod as described in the next step.
5. A single-point ground (the outside case ground lug) must be connected to a copper-clad, 10-foot long, 0.75" diameter steel rod, which is buried, full-length, vertically into the soil as close to the equipment as is practical. (Grounding rod furnished by others.)
6. Resistance between the copper-clad steel ground rod and the earth ground must not exceed 25 Ohms.
7. The equipment-grounding conductors used between the GC and the copper-clad steel ground rod must be sized according to the following specifications:
   - Length, 15 feet or less- AWG 8, stranded, insulated copper wire (4.6 meters)
   - Length, 15 to 30 feet-AWG 6, stranded, insulated copper wire (4.6 to 9.1 meters)
   - Length, 30 to 100 feet-AWG 4, stranded, insulated copper wire (9.1 to 30.5 meters)
8. All inter-enclosure equipment-grounding conductors must be protected by metal conduit.
9. External equipment, such as data printers, that are connected to the GC should be powered via isolation transformers to minimize the ground loops caused by the internally shared safety and chassis grounds.

3.1.5 Electrical Conduit

1	Observe Precautions and Warnings
2	Plan Site Location
3	Obtain Supplies and Tools
4	Install Analyzer Wiring

Follow these general precautions for conduit installation:

1. Conduit cutoffs must be square. Cutoffs must be made by a cold cutting tool, hacksaw, or by some other approved means that does not deform the conduit ends or leave sharp edges.
2. All conduit fitting threads, including factory-cut threads, must be coated with a metal-bearing conducting grease, such as Crouse-Hinds STL or equivalent, prior to assembly.
3. Temporarily cap the ends of all conduit run runs immediately after installation to prevent accumulation of water, dirt, or other contaminants. If necessary, swab out conduits prior to installing the conductors.
4. Install drain fittings at the lowest point in the conduit run; install seals at the point of entry to the GC's purged housing to prevent vapor passage and accumulation of moisture.
5. Use liquid-tight conduit fittings, such as Myers® Scru-Tite® or similar, for conduit which is exposed to moisture.

When conduit is installed in hazardous areas (e.g., areas classified as NEC Class I, Division 1, Groups B, C and D), follow these general precautions for conduit installation:

1. All conduit runs must have an explosion-proof sealing (potting) fitting located within 18 inches (45.5 centimeters) distance from the conduit entrance to explosion-proof housings.
2. The conduit installation must be vapor tight, with threaded hub fittings, sealed conduit joints and gaskets on covers, or other approved vapor-tight conduit fittings.

CAUTION: EQUIPMENT DAMAGE OR PERSONAL INJURY
Consult your company's policies and procedures and other applicable requirements documents to determine wiring and installation practices that are appropriate for hazardous areas. Failure to do so may cause personal injury or damage to equipment.

3.1.6 Sample Systems Requirements

1	Observe Precautions and Warnings
2	Plan Site Location
3	Obtain Supplies and Tools
4	Install Analyzer Wiring

Observe the following guidelines for installing GC sample systems:

Sample Line Length: If possible, avoid long sample lines. In case of a long sample line, flow velocity can be increased by decreasing downstream pressure and using by-pass flow via a speed loop.

Sample Line Tubing Material:

- Use stainless steel tubing for noncorrosive streams.
- Use treated stainless steel, such as Sulfinert or Silcosteel, for streams that contain corrosives, such as hydrogen sulfide.
- Ensure tubing is clean and free of grease.

Dryers and Filters in Sample Line:

- Use small sizes to minimize lag time and prevent back diffusion.
- Install a minimum of one filter to remove solid particles. Most applications require fine-element filters upstream of the Analyzer.
- *Do* use ceramic or porous metallic type filters. *Do not* use cork or felt filters.

Pressure Regulators and Flow Controllers in Sample Line: *Do not* use types containing cork or felt filters, or absorbent diaphragms.

Pipe Threads, Dressing: *Do* use Teflon tape. *Do not* use pipe thread compounds (dope).

Valving:

- Install a block valve downstream of sample takeoff point for maintenance and shutdown.
- Block valve should be gate valve or cock valve type, of proper material and packing, and rated for process line pressure.

3.2 PREPARATION

3.2.1 Introduction

Your Model 1000A Analyzer was started and checked out before it left the factory. Program parameters were installed in the system and documented in the "PC Config Report" furnished with your GC System.

3.2.2 Site Selection

1	Observe Precautions and Warnings
2	Plan Site Location
3	Obtain Supplies and Tools
4	Install Analyzer Wiring

Follow these guidelines for site selection:

- Provide adequate access space for performing maintenance and adjustments.
  - Allow a minimum of 3 feet (.9 m) in front for operator access.
  - If possible, mount the Analyzer components in a vertical stack configuration; it provides the greatest operator convenience.
- Install the Analyzer as close as possible to the sample stream.
- Ensure that exposure to radio frequency (RF) interference is minimal.

3.2.3 Unpacking the Unit

1	Observe Precautions and Warnings
2	Plan Site Location
3	Obtain Supplies and Tools
4	Install Analyzer Wiring

Observe the following checklist for unpacking the unit and inspecting for damage:

1. Unpack the Model 1000A series Analyzer.
2. Ensure that all documentation and software are included:
   (a) This manual, the *Model 1000A Gas Chromatograph Hardware Reference Manual*, P/N 3-9000-750.
   (b) The software manual, *MON2000 Software for Gas Chromatographs User Manual*, P/N 3-9000-522.
   (c) CD(s) with MON2000 and other GC applications.

Installation and startup of the GC should proceed only if all required materials are on hand and free from obvious defects. If any parts or assemblies appear to have been damaged in shipment, first file a claim with the carrier. Next, complete a full report of the nature and extent of the damage and forward the report immediately to Daniel Measurement Services (DMS), a division of Emerson Process Management for further instructions. Include complete model number information. Disposition instructions will be returned immediately by Daniel Measurement Services. Refer to the Customer Repair Report in the back of this manual.

3.2.4 Necessary Tools and Components

1	Observe Precautions and Warnings
2	Plan Site Location
3	Obtain Supplies and Tools
4	Install Analyzer Wiring

Observe the following checklist of tools and components that you will need for installing the Analyzer and GC Controller:

1. Chromatographic grade carrier gas: zero grade helium, nitrogen (99.995% pure, with less than 5 ppm water, and less than 0.5 ppm hydrocarbons), argon, or hydrogen.
2. High pressure dual-stage regulator for the carrier gas cylinder, high side up to 3000 pounds per square inch, gauge (psig), low side capable of controlling pressure up to 150 psig.
3. Calibration standard gas with correct number of components and concentrations (see Section 2.1.6).
4. Dual-stage regulator for the calibration gas cylinder, low pressure side capable of controlling pressure up to 30 psig.
5. Sample probe (fixture for procuring the stream, or sample gas for chromatographic analysis).
6. 1/8-inch stainless steel (SS) tubing for connecting calibration standard to analyzer, 1/4-inch SS tubing for connecting carrier to the analyzer, 1/8-inch SS tubing for connecting stream gas to the analyzer.
7. Miscellaneous Swagelok tube fittings, tubing benders and tubing cutter.
8. 14 American Wire Gauge (AWG) (18 Metric Wire Gauge) or larger electrical wiring and conduit to provide 115 or 230 volts AC, single phase, 50 to 60 Hertz (Hz), from an appropriate circuit breaker and power disconnect switch. See previous guidelines in Section 3.1.2.
9. Liquid leak detector (SNOOP® or equivalent).
10. Digital volt-ohm meter with probe-type leads.

11. A flow measuring device such as Alltech Digital Flow Check™ Flowmeter.

3.2.5 Optional Tools and Components

1	Observe Precautions and Warnings
2	Plan Site Location
3	Obtain Supplies and Tools
4	Install Analyzer Wiring

Observe the following checklist of tools and components you may need for installing and using the GC System:

1. *For operation in a nonhazardous area only*: Printer and printer paper.
2. *For operation in a nonhazardous area only*: An IBM-compatible PC and a "straight-through" serial cable connection between the DB-9 (female) serial ports of the GC Controller and a serial port of the PC. For details, see Section 3.4.2.

WARNING: SERIOUS INJURY OR DEATH POSSIBLE
Do not operate a PC or printer in a hazardous environment. Failure to observe all safety precautions could result in serious injury or death.

If you are working in a hazardous area and need to perform routine operations, use the LOI that is built into the purged electronics enclosure (see Section 4 this manual). To make more significant program changes, however, use a remotely connected PC and the software program MON2000. (See the *MON2000 Software for Gas Chromatographs User Manual*, P/N 3-9000-522, for instructions on operating the PC software, MON2000.)

(a) PC Specifications: Refer to Section 1.4.

(b) Serial Cable Specifications:

Straight-through serial cable with the following terminations:

DB-9, male, connects to GC's serial port

DB-9 or DB-25, female, connects to PC serial port

3. Direct Serial Connect Cable, P/N 3-2350-068, to connect the PC or an external modem directly to the one of the GC's serial ports on the GC's Terminal Board for Field Wiring (TB). This cable comes in a customer-specified length. It is terminated with a DB-9 female plug at one end, for connection to a PC or external modem's serial port, and six exposed leads at the other end for connection to the one of the GC's serial ports on the TB.
4. Items necessary for connecting the GC to an external modem, a multi-drop serial network, or other type of remote data transfer system (an example item might be an RS-232/RS-485 conversion box for long distance serial transmission).
5. Ethernet connection (optional).

3.3 INSTALLING THE ANALYZER

3.3.1 Analyzer AC Power Wiring

1	Observe Precautions and Warnings
2	Plan Site Location
3	Obtain Supplies and Tools
4	Install Analyzer Wiring

To connect 115 volts AC-Power to the Analyzer, follow these steps:

1. Locate the three leads for connecting 115 volts AC-power to the Analyzer.
   (a) Leads are "pig-tailed" from the Analyzer power supply through conduit to a customer power NPT connection at the top of the Analyzer stack.
   (b) Leads are colored as follows:

HOT	black
NEUTRAL	white
GROUND	green

2. Connect Analyzer AC-power leads to properly controlled 115 volts AC-power source (i.e., with circuit breaker and power disconnect switch).

WARNING: SERIOUS INJURY OR DEATH POSSIBLE
Do not connect AC power leads without first ensuring that AC power source is switched OFF. Failure to observe all safety precautions could result in serious injury or death.

(a) Make power line splices and conduit seals that comply with applicable wiring requirements (for hazardous environments).

CAUTION: EQUIPMENT DAMAGE OR PERSONAL INJURY
Do not apply AC electrical power to the Analyzer until all electrical power, interconnection, and external signal connections have been verified, and proper grounds have been made. Failure to properly connect the GC unit may result in serious equipment damage or personal injury.

3. If necessary, connect the Analyzer's chassis ground to an external copper ground rod (at remote locations). See Section 3.1.4 regarding electrical and signal ground.

3.3.2 Sample and Gas Lines

To install GC sample and gas lines:

NOTE: Unless the sample stream is known to react with stainless steel, use tubing of stainless steel construction. Keep tubing internally clean and dry to avoid contamination. Before connection the sample and gas lines, blow clean air or gas through them. Blow out internal moisture, dust, etc.

1. Remove the plug from the Sample Vent (SV) line.
   - If desired, connect the SV line to an external (ambient pressure) vent. If the vent line is terminated in an area exposed to wind, protect the exposed vent with a metal shield.

- Use 1/4-inch or 3/8-inch tubing for vent lines longer than 10 feet.

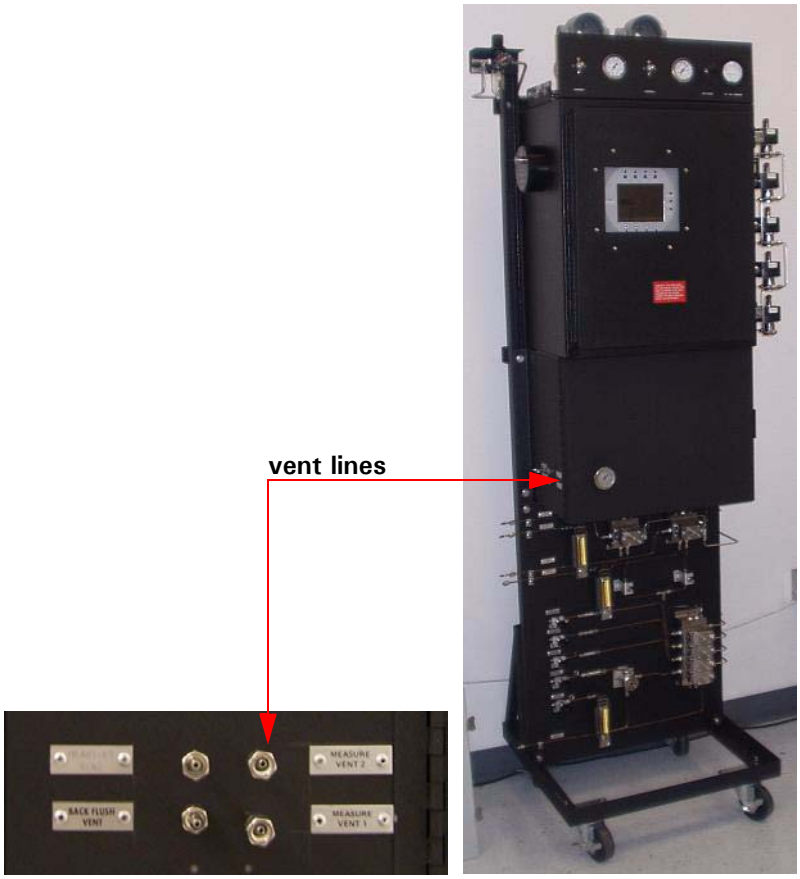


Figure 3-1 Model 1000A Sample and Measure Vent Lines

Note that, at this stage in the installation, the GC Measure Vent (MV) line remains plugged until leak checks are completed. For regular operation, however, the MV line must be unplugged, or open.

Do not discard the vent line plugs. They are useful when leak-checking the GC and its sample and gas line connections.

2. Connect carrier gas to the GC. The carrier gas inlet is labelled "Carrier In" and is a 1/8-inch T-fitting located on the left side of the upper enclosure.

CAUTION: EQUIPMENT DAMAGE OR PERSONAL INJURY
Do not turn on gas until you have completed leak checking the carrier and sample lines. Failure to follow this precaution may cause injury to personnel or damage equipment.

- Use 1/8-inch or 1/4-inch stainless steel tubing to conduct carrier gas.
- Use a dual-stage regulator with high-side capacity of 3000 psig and low-side capacity of 150 psig.
- See Appendix C for a description of a dual-cylinder carrier gas manifold (P/N 3-5000-050) with these features:.
  - Carrier gas is fed from two bottles.
  - When one bottle is nearly empty (100 psig), the other bottle becomes the primary supply.
  - Each bottle can be disconnected for refilling without interrupting GC operation.

3. Connect sample gas stream(s) to the GC inlets located at the bottom of the lower enclosure.

Figure 3-2 Sample Stream Inlets (Right side of unit)

- Use 1/8-inch or 1/4-inch stainless steel tubing to connect sample gasses.

- Ensure that pressure of sample line is regulated to maintain 15 to 30 psig (±10%).

After all lines have been installed, proceed with leak checking the carrier and sample lines. See Section 3.5.1; note that it requires the AC power to be turned on at the GC.

3.4 SETTING THE COM ID

The Model 1000A Com ID is determined by dual inline package (DIP) switch settings.

NOTE: Follow the steps in this section only if you wish to change the Com ID setting and visually inspect and verify the DIP switch settings.

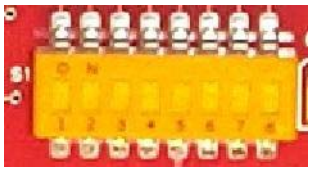


Figure 3-3 Dip Switch

In most cases, the Com ID configuration made at the factory will not need to be changed. The factory DIP switch settings produce a Com ID of 1.

3.4.1 Inspect or Change the Com ID

To visually inspect and verify the DIP switch settings or to change the Com ID settings on the multifunction board, do the following:

1. Disconnect power to unit.

CAUTION: EQUIPMENT DAMAGE OR PERSONAL INJURY
Hazardous voltages present. Failure to properly disconnect the GC unit may result in serious equipment damage or personal injury.

2. Locate the multifunction board in the electronics enclosure. It is in the lower left-hand corner.

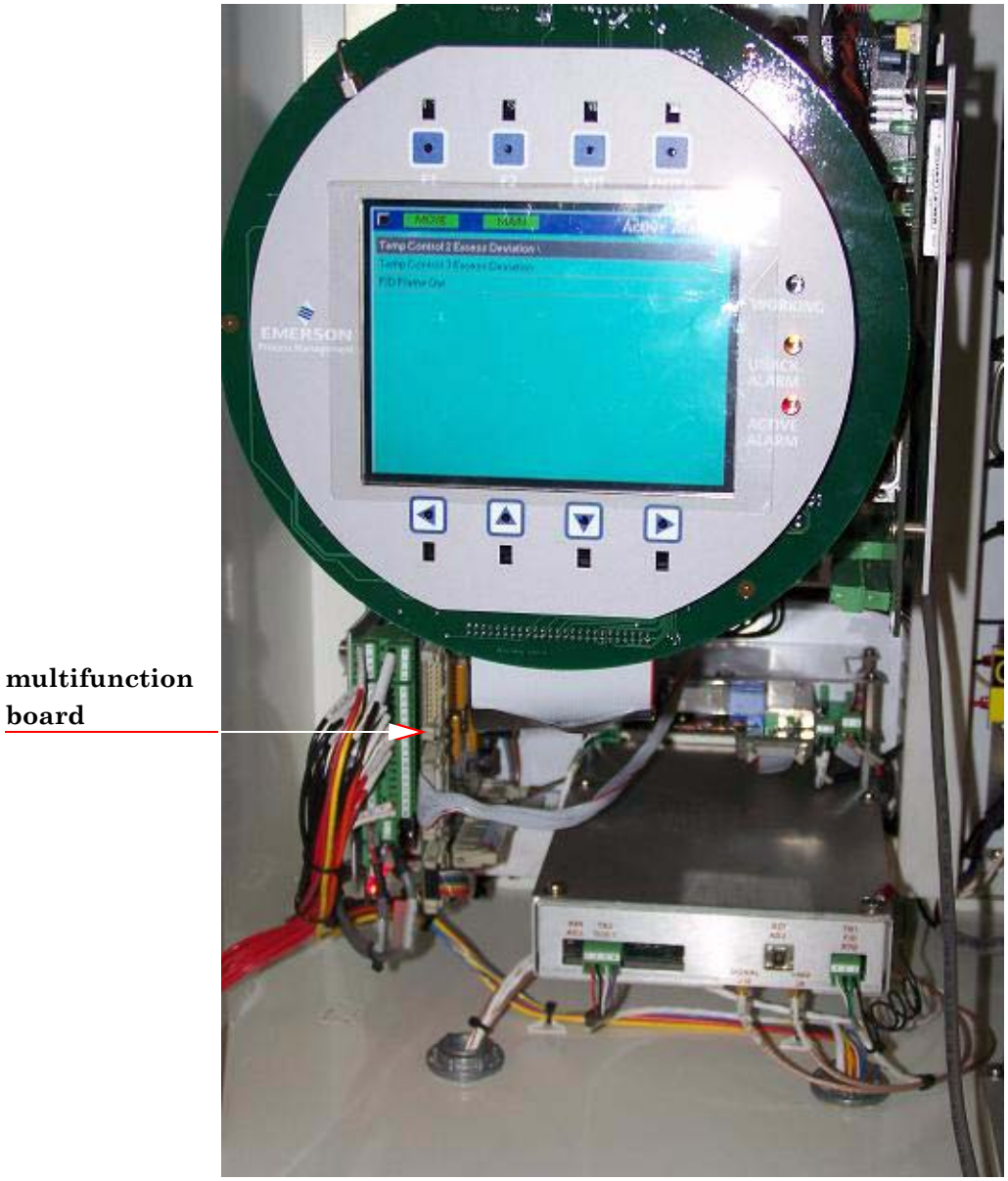


Figure 3-4 Location of the Multifunction board in the upper enclosure

3. Unplug cables from multifunction board and driver I/O board.
4. Unscrew two fasteners holding multifunction board and digital I/O board.

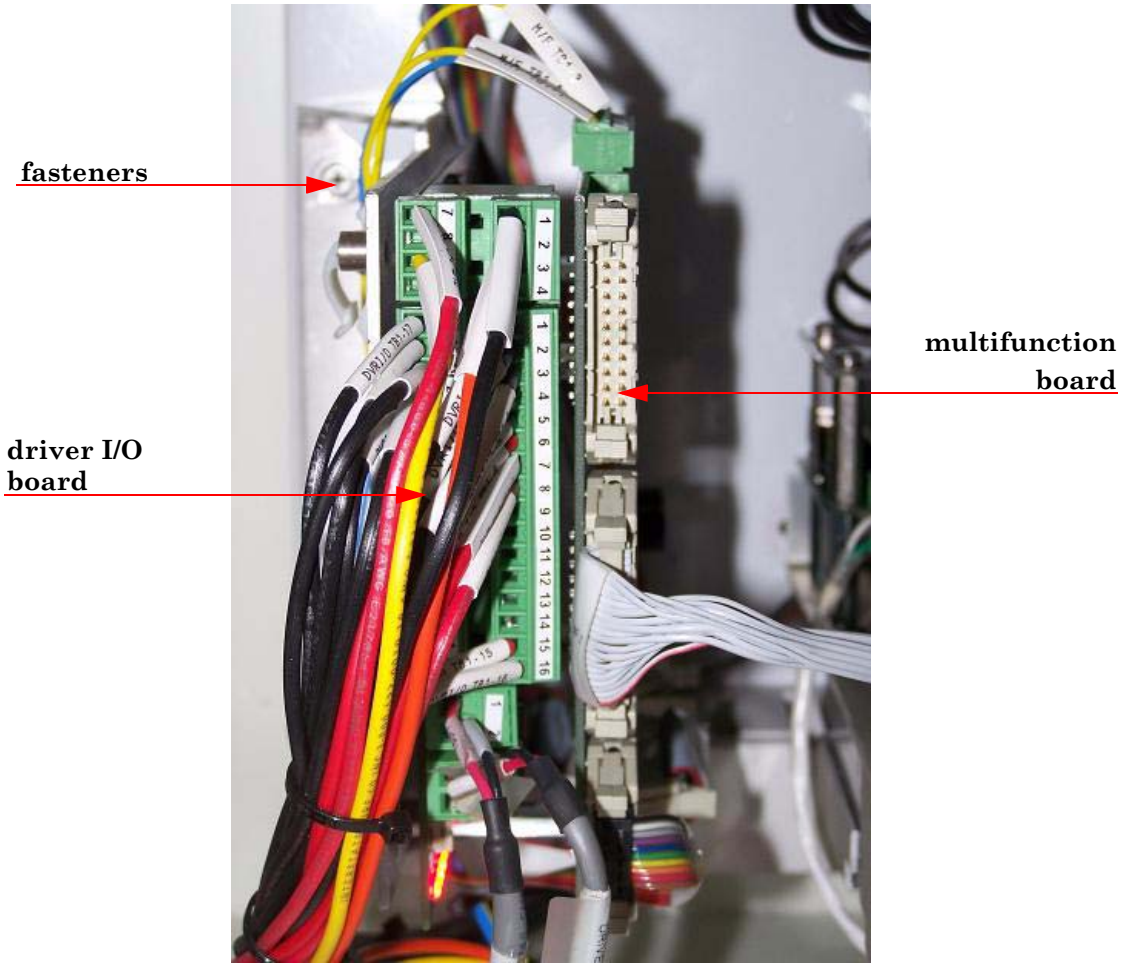


Figure 3-5 Location of cables and fasteners

5. On the multifunction board, locate the Modbus slave address (Com ID) DIP switch. It is labeled “S1” and mounted on the lower right corner of the board.

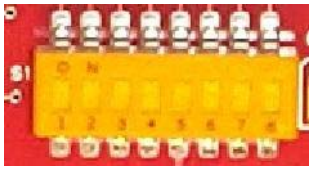


Figure 3-6 Dip Switch

6. Inspect or change the DIP switch as necessary, using the wiring diagram as a guide (see Table 3-2).

   - Make settings on switch S1 located on the multifunction board.
   - Switches "1" through "5" form a 5-bit binary number for setting the Modbus slave address (also known as *Com ID* or *Device ID).*
   - Switch number "1" is the least significant bit, and switch number "5" is the most significant bit. Set these switches either ON or OFF.
   - Switch "6" and "7" are spares and switch "8" is used to cold start the processor (see Table 3-3).

   Use the GC maintenance records to document any changes made to the switch settings.

Table 3-2 Modbus Slave Address (Com ID) DIP Switch Settings

Com ID	1	2	3	4	5
1	ON	OFF	OFF	OFF	OFF
2	OFF	ON	OFF	OFF	OFF
3	ON	ON	OFF	OFF	OFF
4	OFF	OFF	ON	OFF	OFF
5	ON	OFF	ON	OFF	OFF
6	SPARE				
7	SPARE				
8	COLD START				

Table 3-3 Switch Positions for Cold Start

	8
Normal (Run)	OFF
Cold Start	ON

7. Reinstall the multifunction board and driver I/O board, making sure to plug the cables into the proper receptacles.

3.4.2 Preparing for Serial Connections

The method for operating a Model 1000A system is from the LOI or a connected personal computer. The PC must be:

- Running MON2000 software (version 2.2 or later). See the MON2000 *User Manual* (P/N 3-9000-522) for more information.
- Connected to the Model 1000A via some form of communication link, such as an optional ethernet or a serial connection.

This section addresses the basic ways to wire a serial connection between a PC and the GC system.

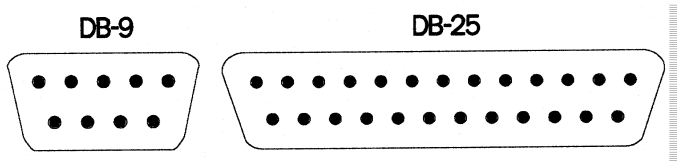
Before connecting a PC to the Model 1000A, determine the following:

1. What serial ports are available at the PC?

   When you select one, consider these points:

   - Standard PC serial ports are type RS-232.
   - Usually there are two external serial port jacks on a PC, located on the rear panel. Most often, they are either DB-9 or DB-25 male (see below).

NOTE: Model 1000A software upgrades can be installed through any available COM port.



- PC serial ports can be used by other peripheral equipment attached to the PC, such as a printer, mouse, or modem, etc.

  To determine which PC serial ports are already being used by other equipment and which port can be used for connecting to the GC, note existing serial connections, refer to your PC user manual, and use diagnostic software (such as Norton Utilities).

2. What serial ports are available at the GC?

   The Model 1000A **without the** Micro-FID is equipped with three serial ports. The installation of the optional Com4A board brings the total number of available serial ports to six.

When you select a serial port, consider these points:

- Com1 and Com2 from the WinSystems CPU board (J1) to Field Termination board (J5 and J7) (standard configuration)
- Com3 from WinSystems CPU board (J6) to the multifunction board
- Com4 from WinSystems CPU board (J6) to Field Termination board

The Model 1000A **with the** Micro-FID comes equipped with two serial ports (standard). The installation of the optional Com4A board bring the total number of available serial ports to six.

When you select a serial port, consider these points:

- Com1 and Com2 from the WinSystems CPU board (J1) to Field Termination board (J5 and J7) standard configuration
- Com3 from WinSystems CPU board (J6) to the multifunction board (J4)
- Com4 from the WinSystems board (J6) is connected to the Micro-FID/TCD Preamplifier board (J4)

For additional serial ports, the:

- Optional Com4A board may be installed at the factory. Com5 through Com8 are fully available to the user and are factory-configured to RS-232 protocol. See Appendix A for additional options (RS-422/485).
- With the optional Com4A board installed, six Com ports are available to the user.

3. Is the connection to be made in a …
   - Short distance between the PC and GC?
   - With temporary or permanent cable connection?

   See Section 3.4.3, FTB Connection (RS-232).
4. Is the connection to be made with a …
   - Short distance between the PC and GC?
   - Permanent cable connection

   See Section 3.4.4, PC to GC Cable Short Distance Connection (RS-232)
5. Is the connection to be made with a …
   - Long distance between the PC and GC?
   - Permanent cable connection

   See Section 3.4.5, Long Distance Connection (RS-422, RS-485)

3.4.3 FTB Connection (RS-232)

The easiest way to connect a PC to the GC is with an off-the-shelf, straight-through serial cable connected to the GC serial port DB 9-pin connector pre-wired on the FTB.

1. Obtain a straight-through serial cable with these specifications:
   - 50 feet long (or less)
   - DB 9-pin or DB 25-pin female plug at one end (for PC connection)
   - DB 9-pin male plug at the other end (for GC connection)

NOTE: You can buy this cable from most computer supply retailers. If, however, it is necessary to custom-wire a cable, see the guidelines provided in Appendix B.

2. Connect the serial cable plugs to the appropriate serial port jacks at the PC and GC. Use the MON2000 software to monitor and operate the GC as needed.

3.4.4 PC to GC Cable Short Distance Connection (RS-232)

The PC-GC connection is made with straight-through serial cable connected to one of the GC serial ports on the FTB.

NOTE: For detailed information concerning serial communications, refer to Appendix A.

If the length of cable can be 50 feet or less, connect the serial cable to one of the GC serial ports configured for RS-232. (Recall that output from a standard PC serial port follows RS-232 serial definition.) Cable that is longer than 50 feet, when used for RS-232 serial transmission, can result in spurious loss or corruption of data.

To connect your PC to one of the Model 1000A serial port jacks, do the following:

1. Access the FTB, which is located to the right of the LOI in the electronics enclosure.

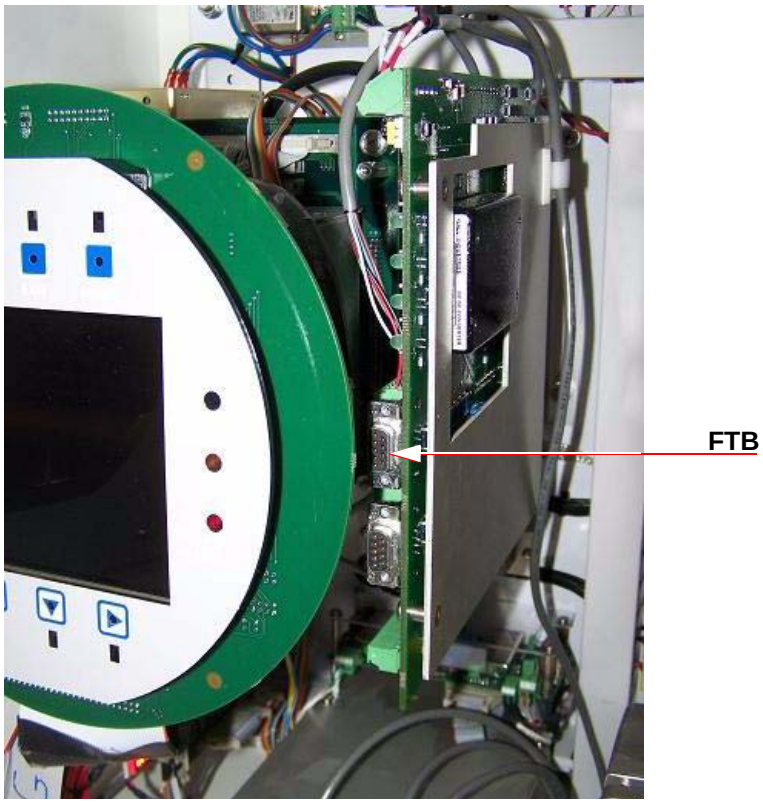


Figure 3-7 Field Termination Board

2. Choose an available serial port on the FTB that is configured for RS-232 protocol.

NOTE: The standard Model 1000A has three communications ports available on the field termination board: Com1, Com2, and Com4.

Unless specified by the customer, serial ports are configured for RS-232.

NOTE: Com4 is dedicated to the FID/TCD preamplifier.

For further details, see Figure 3-8 and Figure 3-9.

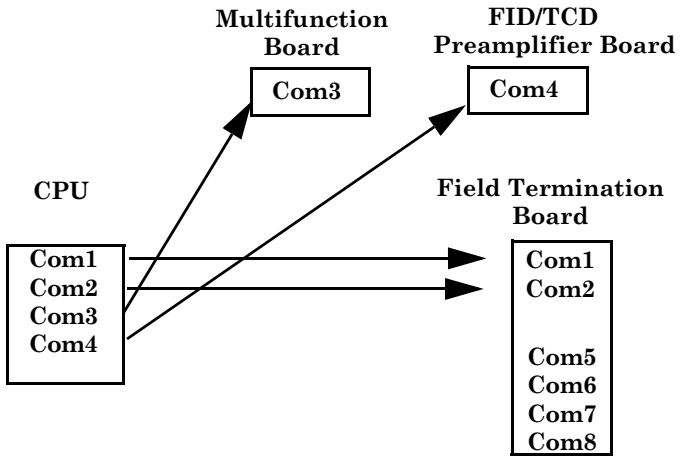


Figure 3-8 Configuration without Com4A Board

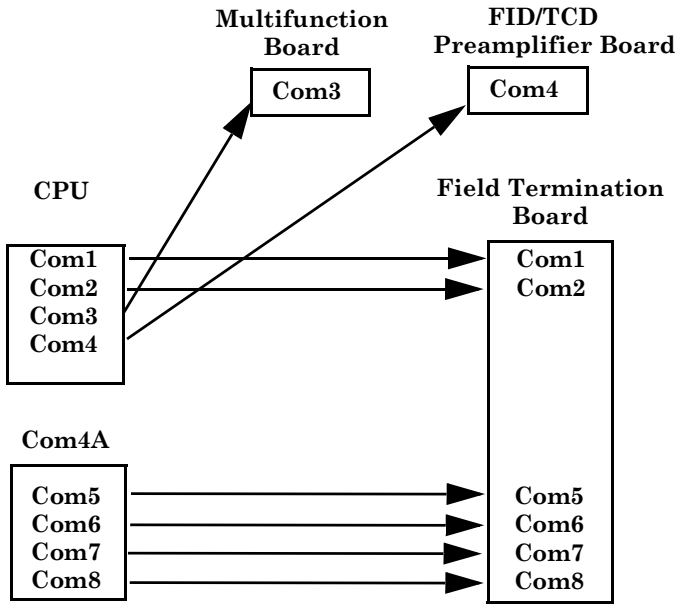


Figure 3-9 Configuration with Com4A Board

NOTE: Com4 is dedicated to the FID/TCD preamplifier.

NOTE: With the Com 4A board installed, the Model 1000A has six communications ports available on the FTB: Com1, Com2, Com5, Com6, Com7, and Com8.

3. Connect the appropriate serial cable.

NOTE: See Appendix A for instructions on fabricating a direct serial cable.

If using a direct 6 conductor serial cable, connect the exposed cable leads to the FTB serial port. A pinout of a female DB 9-pin socket is shown in Figure 3-10.

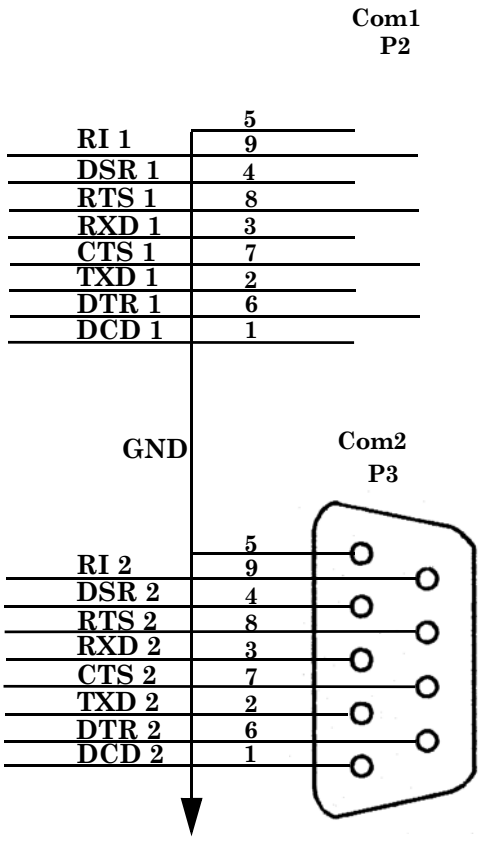


Figure 3-10 FTB Com1 and Com2 DB 9-pin Connector

4. Field Termination Board serial communications settings are shown in Figure 3-11 through Figure 3-15.

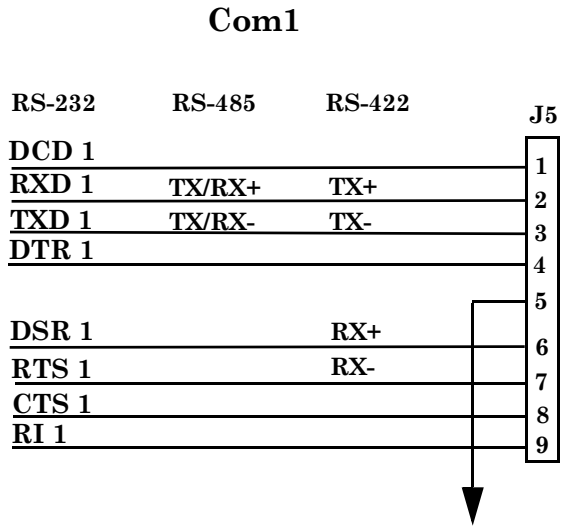


Figure 3-11 FTB Com 1 DB 9-pin Phoenix Connector

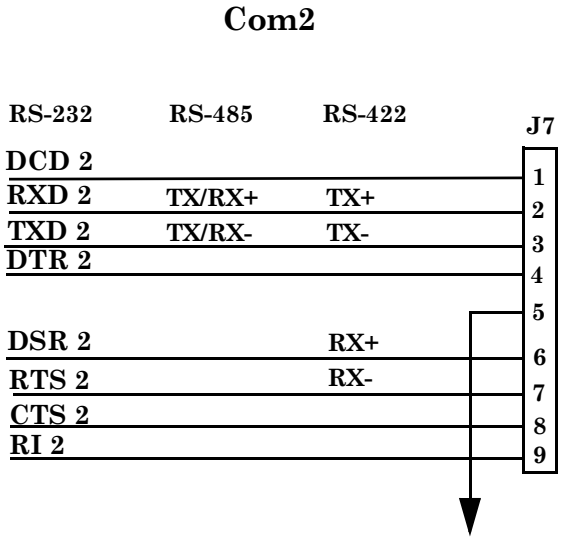


Figure 3-12 FTB Com2 DB 9-pin Phoenix Connector

Com5

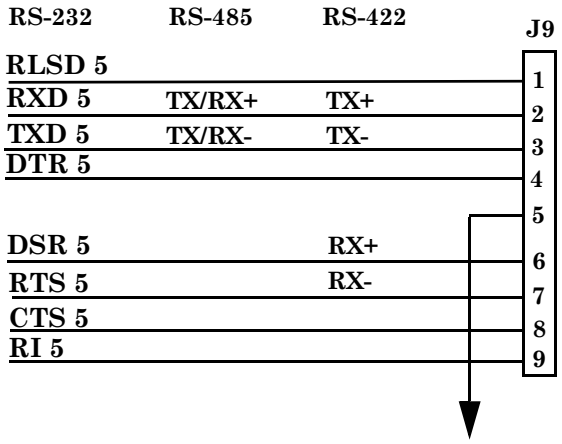


Figure 3-13 FTB Com5 DB 9-pin Phoenix Connector

Com6

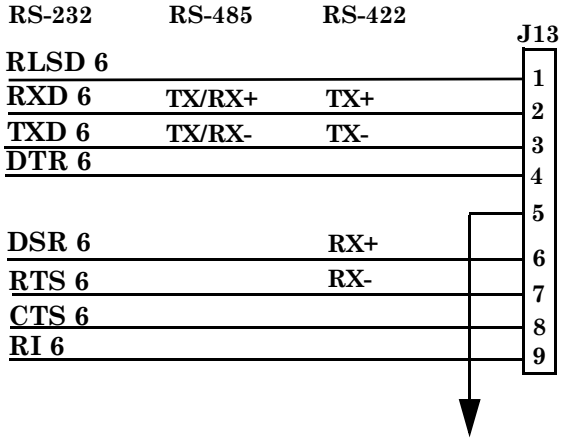


Figure 3-14 FTB Com6 DB 9-pin Phoenix Connector

Com7

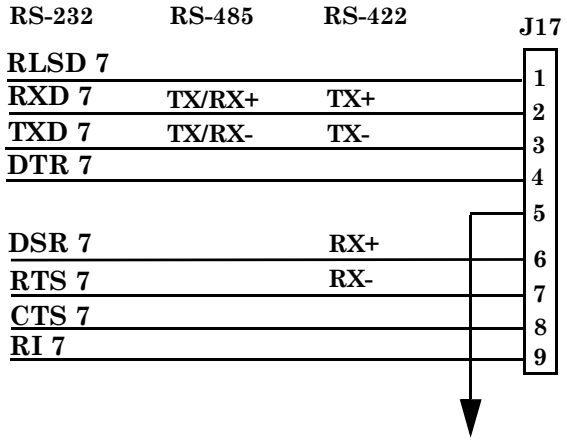


Figure 3-15 FTB Com7 DB 9-pin Phoenix Connector

Com8

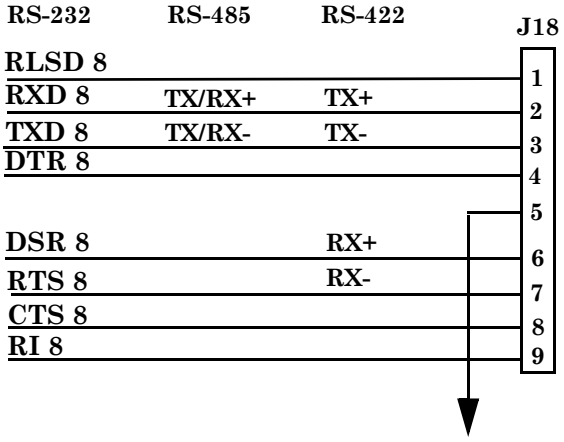


Figure 3-16 Com8 DB 9-pin Phoenix Connector
GC Phoenix Plug Port

To make an RS-232 serial connection between one of the Phoenix Plug serial ports of the GC, and an external modem with DB 25-pin serial port, you will need to manufacture the cable and its DB 25-pin, male plug cable end as illustrated below (see Figure 3-17).

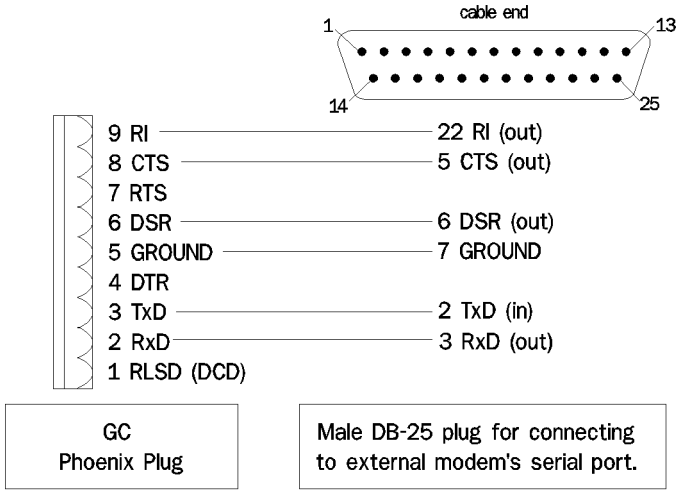


Figure 3-17 GC Phoenix Plug Port to External Modem DB 25-pin Port

3.4.5 Long Distance Connection (RS-422, RS-485)

RS-422 and RS-485 serial protocols are recommended for longer distance serial connections between the PC and GC System (i.e., distances greater than the 50 feet).

To connect your PC to one of the internal Model 1000A RS-422/RS-485 serial port jacks:

1. Obtain the following equipment:
   - An asynchronous line driver (or interface device) with RS-232 input and RS-422/RS-485 output. See Appendix A for example brand and model.
   - Shielded, computer-grade, twisted pair cable (to connect the asynchronous line driver device to the GC).
   - A straight-through serial cable (to connect the PC to the line driver).

2. Connect the straight-through serial cable from the PC serial port to the RS-232 serial port of the line driver device. Then connect the twisted pair cable to the RS-422/RS-485 serial port of the line driver.
3. Configure the line driver for data communications equipment (DCE) operation. See Appendix A for an example configuration.
4. Access the FTB (see Figure 3-7 in Section 3.4.2).
5. Choose an available serial port on FTB that is configured for RS-422 or RS-485 serial protocol, and connect the twisted pair cable from the line driver. See Appendix A for example connection. Also see Figure 3-11 through Figure 3-15 for a list of ports and terminals assigned for serial communications.

NOTE: Serial ports Com1, Com2, and Com3 are configured by default for RS-232. For further details or instructions on how to configure these ports to RS-422/485, see Appendix A.

3.4.6 Ethernet Connection (Optional)

Table 3-4 J1 PCM-NE2000 Ethernet Board Jumper Settings

Pin(s)	Position
15 and 16	In
17 and 18	In
21 and 22	In

Table 3-5 J2 PCM-NE2000 Ethernet Board Jumper Settings

Pin(s)	Position
1 and 2	In

Table 3-6 J3 PCM-NE2000 Ethernet Board Jumper Settings

Pin(s)	Position
1 and 2	In
7 and 8	In

3.4.7 GC-Printer Wiring

A printer can be connected directly to the GC the field termination board (FTB) at one of the serial ports. The type and scheduling of reports produced at the GC printer are determined by settings made in MON2000 (from the Reports menu, select GC Report Request and/or GC Printer Control; see the MON2000 *Software for Gas Chromatographs User Manual* (P/N 3-9000-522) for more information).

NOTE: The GC uses a generic printer driver. The PC printer allows more control and better quality output.

To connect a printer to the GC serial port, do the following:

1. Access the FTB (see Figure 3-7 in Section 3.4.2).
2. Choose an available serial port on the FTB that is configured for RS-232 serial protocol.

NOTE: See Appendix A for a complete listing of the serial ports and corresponding pinouts to fabricate a serial printer cable.

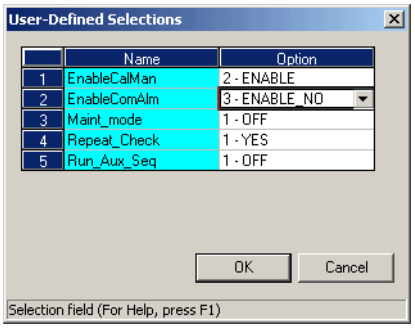
3. After the wiring connections have been completed, use MON2000 to configure the GC serial port.
   (a) From the Application menu, select *Serial Ports*. The Serial Ports window appears.
   (b) Select the appropriate Port row and set *Usage* to "Report", *Protocol* to "ASCII" and *RW* to "W".
   (c) Ensure that the *Com ID* setting is correct.

(d) Leave all other settings at the default values (see the MON2000 user manual for more information).

3.4.8 Discrete Digital I/O Wiring

The field termination board (P/N 3-0700-010) has five discrete outputs and four discrete inputs. Refer to the *MON2000 Software for Gas Chromatographs Manual (P/N 3-9000-522)* to configure the digital outputs.

NOTE: To configure the digital output with MON2000, go to *Application* → *User Defined* → *Selections* and set EnableComAlm to either normally open or normally closed.



Discrete Digital Inputs

To connect digital signal input/output lines to the GC, do the following:

1. Access the Field Termination Board (FTB) (P/N 3-0700-010).

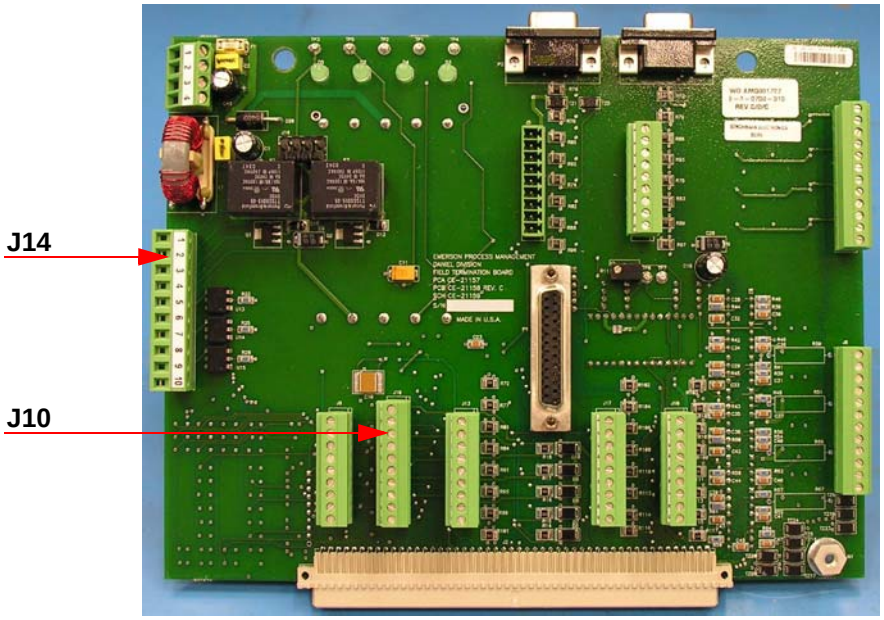


Figure 3-18 Field Termination Board

The FTB has five discrete outputs and four discrete inputs. The discrete input, DIG_IN4, is dedicated to a pressure switch. The discrete inputs are located on J10 (10 pin Phoenix connector).

2. Route digital I/O lines appropriately, especially in the case of the explosion-proof enclosure.

   There are connections for four digital inputs and five digital output lines (Phoenix 10-pin connector), as follows:

Table 3-7 FTB Discrete Digital Inputs

J10	Function	Description
Pin 1	DIG_IN1	
Pin 2	GND	
Pin 3	DIG_IN2	
Pin 4	GND	
Pin 5	DIG_IN3	to customer

Table 3-7 FTB Discrete Digital Inputs

J10	Function	Description
Pin 6	GND	
Pin 7	DIG_IN4	dedicated to a pressure switch
Pin 8	GND	dedicated to a pressure switch
Pin 9	DIG_IN5	
Pin 10	GND	

Discrete Digital Outputs

The discrete outputs are located on J14 (P/N 3-0700-010) (Phoenix 10-pin connector) have two "Form A" relays on the FTB. Outputs 3-5 are Solid State switches with a rating of .375A @30 VDC. The relays, with sealed enclosures, have a contact current rating of 1.0 Amperes each (see Figure 3-18).

For discrete digital outputs, see Table 3-8.

Table 3-8 FTB Discrete Digital Outputs

J14	Function
Pin 1	DIG_OUT
Pin 2	DIG_OUT
Pin 3	DIG_OUT
Pin 4	DIG_OUT
Pin 5	DIG_OUT_ 3+
Pin 6	DIG_OUT_ 3-
Pin 7	DIG_OUT_ 4+
Pin 8	DIG_OUT_ 4-
Pin 9	DIG_OUT_ 5+
Pin 10	DIG_OUT_ 5-

3.4.9 Analog Input Wiring

There are four analog inputs on the Field Termination Board (P/N 3-0700-010 and drawing CE-21157) located at J4 (12-pin Phoenix connector).

Table 3-9 FTB Analog Inputs

J4	Function
Pin 1	VIN+_1
Pin 2	VIN-_1
Pin 3	Shield
Pin 4	VIN+_2
Pin 5	VIN-_1
Pin 6	Shield
Pin 7	VIN+_3
Pin 8	VIN-_1
Pin 9	Shield
Pin 10	VIN+_4
Pin 11	VIN-_1
Pin 12	Shield

3.4.10 Analog Output Wiring

There are four standard analog outputs on the standard FTB (P/N 3-0700-010 and drawing CE-21157); located at J8 (12-pin Phoenix connector). Additionally, if installed, the optional analog board has eight analog outputs

Table 3-10 FTB Analog Outputs

J8	Function
Pin 1	IOUT+_1
Pin 2	IOUT-_1
Pin 3	Shield
Pin 4	IOUT+_2
Pin 5	IOUT-_2
Pin 6	Shield
Pin 7	IOUT+_3
Pin 8	IOUT-_3
Pin 9	Shield
Pin 10	IOUT+_4
Pin 11	IOUT-_4
Pin 12	Shield

There are eight analog outputs on the optional analog output board (P/N 2-3-0580-037 and drawing CE-21157); located at J3 (24-pin Phoenix connector):

Table 3-11 Optional Analog Outputs

J3	Function
Pin 1	IOUT+_5
Pin 13	IOUT-_5
Pin 2	Shield
Pin 14	IOUT+_6
Pin 3	IOUT-_6
Pin 15	Shield
Pin 4	IOUT+_7
Pin 16	IOUT-_7
Pin 5	Shield
Pin 17	IOUT+_8
Pin 6	IOUT-_8
Pin 18	Shield
Pin 7	IOUT+_9
Pin 19	IOUT-_9
Pin 8	Shield
Pin 20	IOUT+_10
Pin 9	IOUT-_10
Pin 21	Shield
Pin 10	IOUT+_11
Pin 22	IOUT-_11
Pin 11	Shield
Pin 23	IOUT+_12
Pin 12	IOUT+_12
Pin 24	Shield

3.4.11 Optional Boards

Optional modem boards are available for the Model 1000A GC.

The jumper settings and pinouts for each board is shown below.

Optional WinSystems Modem

Table 3-12 J8 Modem Board Jumper Settings

Pin(s)	Position
1 and 2	In
3 and 4	In
5 and 6	In
7 and 8	In

Table 3-13 J9 Modem Board Jumper Settings

Pin(s)	Position
1 and 2	In
5 and 6	In

Table 3-14 J10 Modem Board Jumper Settings

Pin(s)	Position
1 and 2	In
3 and 4	In
5 and 6	In
9 and 10	In
15 and 16	In

Optional Radicom Modem Settings

Table 3-15 J26 Radicom Modem Jumper Settings

Pin(s)	Position
1 and 2	In

Table 3-16 J27Radicom Modem Jumper Settings

Pin(s)	Position
1 and 2	In

Table 3-17 J30 Radicom Modem Jumper Settings

Pin(s)	Position
1 and 2	In

Table 3-18 J31 Radicom Modem Jumper Settings

Pin(s)	Position
2 and 3	In

3.5 ANALYZER LEAK CHECKS AND PURGING FOR FIRST CALIBRATION

3.5.1 Analyzer Leak Checks

4	Install Analyzer Wiring
5	Install Analyzer Sample & Gas Lines
6	Install GC Controller Wiring
7	Perform Leak Checks

To perform Analyzer leak checks, follow these steps:

1. Plug the Measure Vent (labeled "MV") vent line if it is open. (The "SV", or Sample Vent line should be left open, or unplugged.)
2. Slowly pressurize each line in turn, then block-in the line, making sure the pressure holds. For example, the carrier gas line should be slowly brought up to 110 psig (±2 percent) with the dual-stage regulator at the gas cylinder.
3. After 2 minutes, shut the carrier gas bottle valve and observe the high-side regulator gauge.
   (a) The gauge should not bleed down more than 100 psig in 10 minutes.
   (b) If the carrier gas is lost at a faster rate, leaks are usually found between the carrier gas bottle and the Analyzer. Check and tighten all connections, as well as the dual-stage regulator.
4. When the leak check is complete, reopen the carrier gas bottle valve. Remove the plug from the MV line.
5. Repeat the procedure with sample gas and stream gas after first shutting the metering valve below the rotameter on the front of the Flow Panel. The metering valve is left shut for now, but will be reopened later during initial purging and the Analyzer's first calibration.

3.5.2 Purging Carrier Gas Lines

7	Perform Leak Checks
8	Purge Carrier Gas Lines
9	Purge Calibration Lines
10	Start Up GC System

CAUTION: EQUIPMENT DAMAGE OR PERSONAL INJURY
Purging carrier and calibration gas lines will require that AC power be turned on to the Analyzer. Ensure that unit interconnections and all external signal connections have been verified, and proper grounds have been made. Failure to verify all connections may result in equipment damage or personal injury.

NOTE: Tubing should be clean and dry internally. During installation use compressed air to remove moisture, dust, or other contaminants from all tubing.

To purge the carrier gas lines, as preparation for first calibration, follow these steps:

1. Ensure that the "MV" vent line plug has been removed, and the vent line is open.

2. Turn on the AC power to the Analyzer. The LOI will turn on.

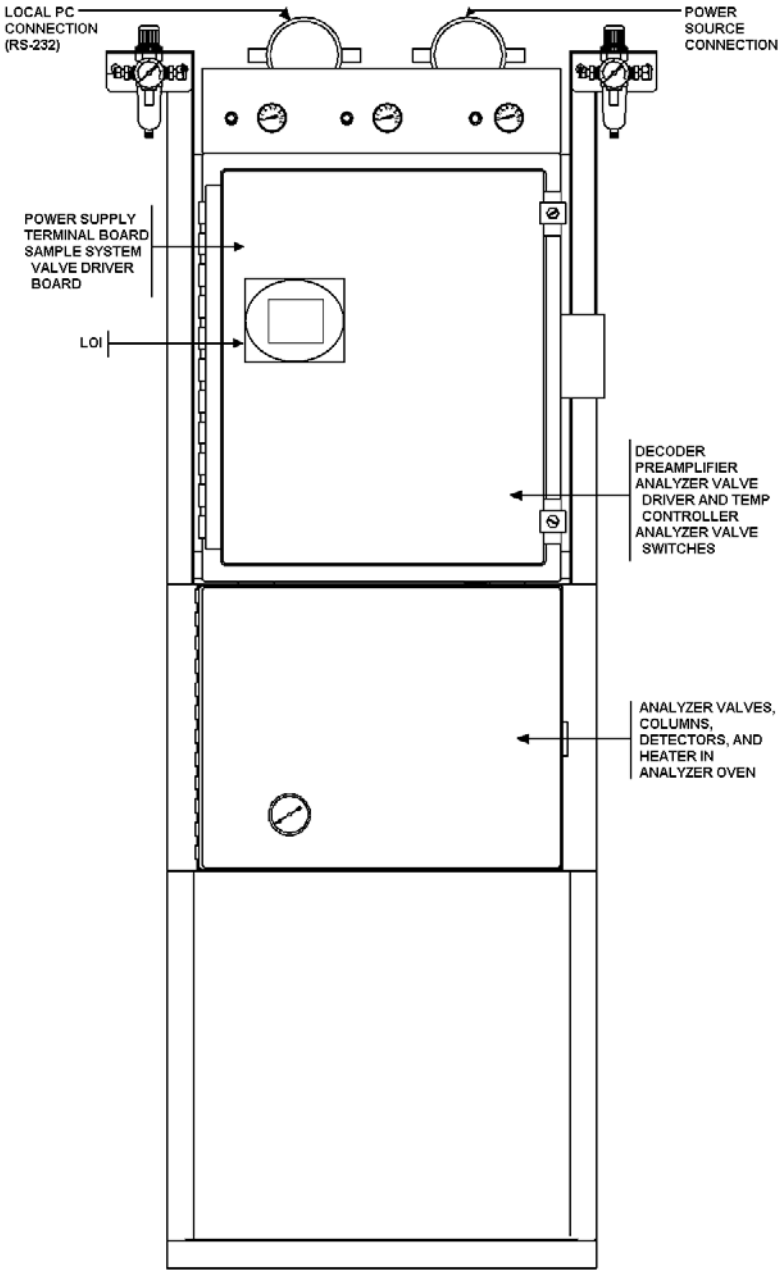

LOCAL PC CONNECTION (RS-232)
POWER SOURCE CONNECTION
POWER SUPPLY TERMINAL BOARD
SAMPLE SYSTEM VALVE DRIVER BOARD
LOI
DECODER PREAMPLIFIER
ANALYZER VALVE DRIVER AND TEMP CONTROLLER
ANALYZER VALVE SWITCHES
ANALYZER VALVES, COLUMNS, DETECTORS, AND HEATER IN ANALYZER OVEN

Figure 3-19 Analyzer components

3. Using the LOI or MON2000, ensure that all of the Analyzer valves are set to the AUTO position.
4. Ensure that the carrier gas bottle valve is open.
5. Using the LOI or MON2000, set the calibration gas stream (Stream 2 by default) to the "ON" position.

NOTE: Do not use the "Carrier Pressure Adjust" valve (on the Flow Panel of the Analyzer) to adjust carrier gas line pressure. That valve is factory-set and should not be adjusted.

3.5.3 Purging Calibration Gas Lines

7	Perform Leak Checks
8	Purge Carrier Gas Lines
9	Purge Calibration Lines
10	Start Up GC System

To purge the calibration gas lines, as preparation for first calibration, follow these steps:

1. Ensure that the carrier gas lines have been fully purged, as described in the previous section.
2. Close the calibration gas bottle valve.
3. Fully open the block valve associated with calibration gas feed (the block valve should be located on the SCS plate of the Analyzer).
4. Fully open the metering valve (on the Flow Panel, below the rotameter).
5. Open the electronics enclosure to access the valve driver board.
6. On the valve driver board, upper enclosure, set the Stream switch "S2" to MAN (if Stream 2 will be used for calibration gas).
7. Open the calibration gas bottle valve.

8. At the calibration gas bottle regulator, increase outlet pressure to 20 psig, ±5%.
9. Close the calibration gas bottle valve.
10. Let both gauges on the calibration gas bottle valve bleed down to 0 (zero) psig.
11. Repeat steps (7) through (10) five times.
12. Open the calibration gas bottle valve.
13. Regulate the flow through the rotameter to approximately 50 cubic centimeters per minute (cc/min) by adjusting the metering valve on the Flow Panel.
14. To prepare for normal operation, set the calibration gas stream switch (Stream 2 by default) to AUTO using the LOI or MON2000.

3.6 SYSTEM START-UP

7	Perform Leak Checks
8	Purge Carrier Gas Lines
9	Purge Calibration Lines
10	Start Up GC System

To perform system start-up, follow these steps:

1. For system startup, run an analysis of the calibration gas.

   (a) If equipped with an optional stream switching board, ensure that the stream switch for the calibration stream is set to AUTO.

   Otherwise, ensure that the calibration gas supply is turned on and set to the correct pressure (25 to 30 PSIG).

   (b) Use MON2000 to run a single stream analysis on the calibration stream. Once proper operation of the GC is verified, halt the analysis by selecting *Control → Calibration and Control → Halt*. See the *MON2000 Software for Gas Chromatographs User Manual (*P/N 3-9000-522*)* for more information.

2. Start Auto Sequence of the line gas stream(s) by selecting *Control* → *Auto Sequence*. See the *MON2000 Software for Gas Chromatographs User Manual* for more information. The GC will begin the Auto Sequence analysis mode.

MAINTENANCE AND TROUBLESHOOTING

4.1 HAZARDOUS ENVIRONMENTS

WARNING: EQUIPMENT DAMAGE OR PERSONAL INJURY
Observe all precautionary signs posted on the Model 1000A enclosure. Failure to do so can result in injury or death to personnel or cause damage to the equipment.

WARNING: EQUIPMENT DAMAGE OR PERSONAL INJURY
The Model 1000A enclosures are rated for a general purpose area. The enclosures are certified by CSA for Class I Division 2 Groups B, C, and D locations, Temperature Code T3 with an optional Type Z purge.

Special conditions for safe use must be met. The maximum constructional gap (ic) is less than that required by Table 1 of IEC 60079-1:2004 as detailed in the Table 4-1 below.

Before opening the Model 1000A assembly, reduce the risk of igniting hazardous atmospheres by disconnecting the equipment from all power supplies. Keep the assembly closed tightly when in operation to reduce the risk of igniting hazardous atmospheres.

Inlet (incoming) wiring must meet local standards (i.e. in conduit with seal fitting within 18" or via cable glands certified to IEC 60079-1). Seal all unused entries with blanks certified to IEC 60079-1.

Please direct all health, safety and certification related questions to: Emerson Process Management, Gas Chromatographs, Applications Engineering Group, 713-827-6380 or 1-866-GC Center (1-866-422-3683).

Table 4-1 Flamepath Fitting Tube Gap Safety

FLAMEPATH	MAXIMUM GAP (MM)	COMMENT
Fitting tube adaptor/fitting tube taper	0.000	Taper fit
Fitting tube/taper/tubes	0.132	

4.2 TROUBLESHOOTING AND REPAIR CONCEPT

The most efficient method for maintaining and repairing the Model 1000A GC system is a component-replacement concept that allows you to return the system to operation as quickly as possible. Sources of trouble, such as printed-circuit assemblies, valves, etc., are identified during troubleshooting test procedures and are replaced at the lowest level practical with units in known working order. The defective components are then either repaired in the field or returned to Measurement Services for repair or replacement.

4.3 ROUTINE MAINTENANCE

The Model 1000A GC system will perform accurately for long periods with very little attention (except for maintaining the Carrier Gas cylinders). A bimonthly record of certain parameters will assist greatly in assuring that your Model 1000A is operating to specifications. The maintenance checklist should be filled out bimonthly, dated, and kept on file for access by maintenance technicians as necessary (see Table 4-2).This gives you a historical record of the operation of your Model 1000A, enables a maintenance technician to schedule replacement of gas cylinders at a convenient time, and allows quick troubleshooting and repair when it becomes necessary.

A chromatogram, a Configuration Report, and a Raw Data Report should also be made and filed with the checklist, furnishing a positive dated record of the Model 1000A. The chromatogram and reports can also be compared to the chromatograms and reports run during the troubleshooting process.

4.3.1 Bimonthly Maintenance Checklist

Copy the sample maintenance checklist as necessary for your files (see Table 4-2). If you have a problem, please complete the checklist and reports, and have the results available when calling Measurement Services with a problem. Also have the Sales Order number. The Sales Order number can be found on the nameplate located on the left side wall

of the upper housing of the Model 1000A. The chromatograms and reports archived when your Model 1000A left the factory are filed by this number.

Table 4-2 Maintenance Checklist

Date Performed:	Sales Order Number:		
System Parameters	As Found	As Left	Nominal
Carrier Gas Cylinder			
Cylinder Pressure Reading (High)	____ psig	____ psig	____ psig
Cylinder Pressure Outlet Reading	____ psig	____ psig	110 psig
Carrier Pressure Panel Regulator	____ psig	N/A	85 psig
Sample System			
Sample Line Pressure(s)	(1)____ psig	____ psig	20 psig
	(2)____ psig	____ psig	20 psig
	(3)____ psig	____ psig	20 psig
	(4)____ psig	____ psig	20 psig
	(5)____ psig	____ psig	20 psig
Sample Flows	(1)___ cc/min	____cc/min	40-60 cc
Sample Vent 1 (SV1)	(2)___ cc/min	____cc/min	40-60 cc
Sample Vent 2 (SV2)	(3)___ cc/min	____cc/min	40-60 cc
	(4)___ cc/min	____cc/min	40-60 cc
	(5)___ cc/min	____cc/min	40-60 cc
Calibration Gas			
High Pressure Reading	____ psig	____ psig	
Outlet Pressure Reading	____ psig	____ psig	20 psig
Flow	____ cc/min	___ cc/min	40-60 cc

4.3.2 Routine Maintenance Procedures

- Complete the maintenance checklist bi-monthly. Place the sales order number, date, and time on the form and file it. This gives you a basis for comparison in the future if you need it.
- Save a Chromatogram of the operating Model 1000A on the PC with the MON 2000 software. Print Configuration, Calibration, and Raw Data reports and file them with the MON 2000.
- Check the printer paper (if used) to ensure that a sufficient supply of paper remains. Check carrier and calibration gas supplies.

4.3.3 Contact Service

Measurement Services offers maintenance service programs that are tailored to fit specific requirements. Contracts for service and repair can be arranged by contacting Measurement Services at the address or telephone number on the Customer Repair Report at the back of this manual.

4.4 ACCESS TO GC EQUIPMENT ELEMENTS

4.4.1 Electrical/Electronic Components

WARNING: EQUIPMENT DAMAGE OR PERSONAL INJURY
The electronics enclosure should not be opened when the unit is exposed to an explosive environment. If access to the eletronics enclosure is required, precautions must be taken to ensure that an explosive environment is not present. Failure to do so may result in injury or death to personnel or cause damage to the equipment.

The Model 1000A electrical/electronic components are located in the electronics enclosure. All of the electrical/electronic components are fully accessible from the front of the GC.

Figure 4-1 Model 1000A electronics enclosure, front view

Model 1000A with TCD Electronics Enclosure

- Multifunction Board
- Dual Methods Adapter Board
- Dual Methods Preamplifier Board
- Solenoid Heater/Driver Board
- WinSystems CPU Board
- Analog Board
- Com4A Board (optional)
- Ethernet Board (optional)
- Radicom Modem board (optional)
- DC/DC Field Termination Board

- Eight Channel Analog (non-isolated 4-20mA) Output Board (optional)
- Four Channel Analog (isolated 4-20mA) Output Board (optional)

Model 1000A with Micro-FID/TCD Electronics Enclosure

- Multifunction Board
- Solenoid/Heater Driver Board
- FID/TCD Preamplifier Board with ADC
- FID/TCD Preamplifier Power Supply Board
- FID Connector Board
- Field Termination Board
  - Backplane Board
  - Interconnect Board
- WinSystems CPU (with PC104 interface)
- Com4A PC/104 Board (optional)
- Ethernet Board (optional)
- Radicom Modem Board (optional)

NOTE: The optional Radicom Modem is always mounted on top of the PC/104 card stack.

- Eight Channel Analog (non-isolated 4-20mA) Output Board (optional)
- Four Channel Analog (isolated 4-20mA) Output Board (optional)
- Front Panel Analytical and Stream Switch Panel

- Dual Methods Adapter Board

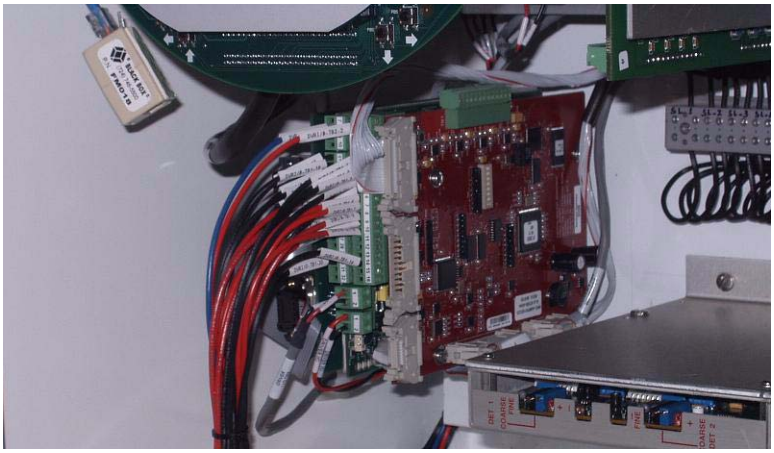


Figure 4-2 CPU, Com4A, and Modem Boards

NOTE: The optional Ethernet board is not shown, but plugs into the CPU board or the Com4A board.

4.4.2 Detector Elements, Heater Elements, Valves and Columns

The detector elements, heater elements, valves and columns are located in the air bath oven located in the enclosure directly beneath the eletronics housing.

Figure 4-3 Air bath oven

The detector elements, including the FID, are each located in a seperate housing inside the air bath oven.

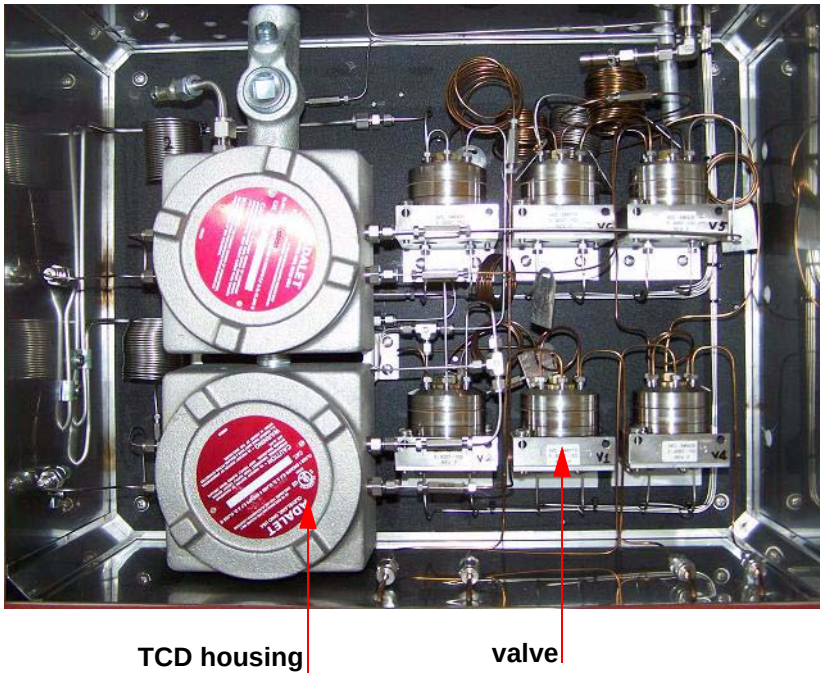


Figure 4-4 TCDs and valves

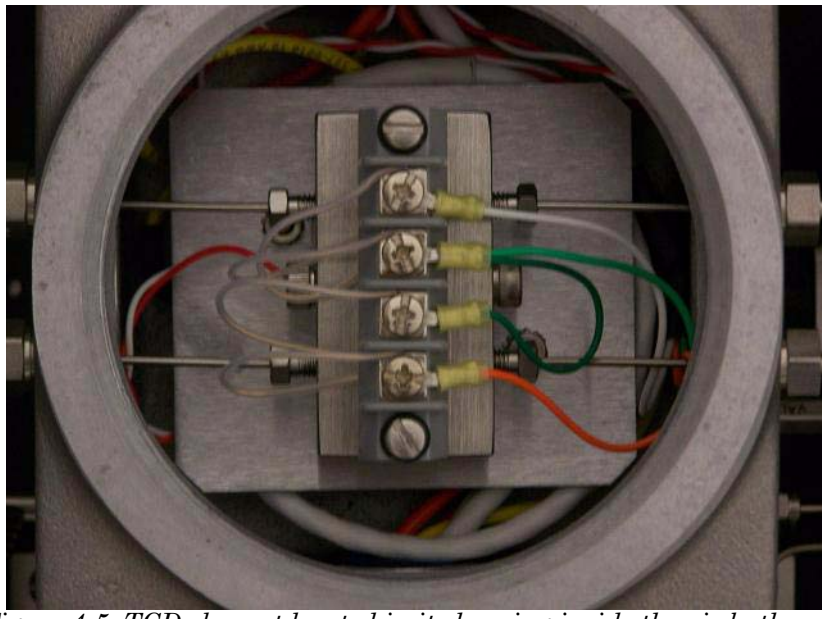


Figure 4-5 TCD element located in its housing inside the air bath oven

4.5 PRECAUTIONS FOR HANDLING PC ASSEMBLIES

Printed circuit assemblies contain CMOS integrated circuits, which can be damaged if the assemblies are not properly handled. The following precautions must be observed when working with the assemblies:

- Do not install or remove the Model 1000A printed circuit assemblies while power is applied to the units.
- Keep electrical components and assemblies in their protective (conductive) carriers or wrapping until ready for use.
- Use the protective carrier as a glove when installing or removing printed circuit assemblies.
- Maintain contact with a grounded surface to prevent static discharge when installing or removing printed circuit assemblies.

4.6 GENERAL TROUBLESHOOTING

This section contains general troubleshooting information for the Model 1000A. The information is arranged as appropriate either by major subsystems or by major functions of the instrument. See Table 4-3 for frequent possible causes of the hardware alarms.

NOTE: Correct ALL alarms before re-calibration.

4.6.1 Hardware Alarms

Use the following table to identify the alarm and possible cause to remedy the problem.

Table 4-3 Basic Hardware Troubleshooting via Alarms

Alarm	Possible Cause
Application Checksum Failure	DiskOnChip
ROM Checksum Failure	DiskOnChip
RAM Diagnostics Failure	bad RAM

Table 4-3 Basic Hardware Troubleshooting via Alarms (Continued)

Alarm	Possible Cause
Micro-FID/TCD Preamplifier Alarms Micro-FID Temperature High Micro-FID Comm. Failure	extinguished flame
Analog Output 1 High	Measured value program for Analog Output 1 is greater than user-defined full scale range.
Analog Output 2 High Analog Output 3 High Analog Output 4 High Analog Output 5 High Analog Output 6 High Analog Output 7 High Analog Output 8 High Analog Output 9 High Analog Output 10 High Analog Output 11 High Analog Output 12 High	same as Analog Output 1 High same as Analog Output 1 High same as Analog Output 1 High same as Analog Output 1 High same as Analog Output 1 High same as Analog Output 1 High same as Analog Output 1 High same as Analog Output 1 High same as Analog Output 1 High same as Analog Output 1 High same as Analog Output 1 High
Analog Output 1 Low	Measured value program for Analog Output 1 is lower than user-defined zero range.
Analog Output 2 Low Analog Output 3 Low Analog Output 4 Low Analog Output 5 Low Analog Output 6 Low Analog Output 7 Low Analog Output 8 Low Analog Output 9 Low Analog Output 10 Low Analog Output 11 Low Analog Output 12 Low	same as Analog Output 1 Low same as Analog Output 1 Low same as Analog Output 1 Low same as Analog Output 1 Low same as Analog Output 1 Low same as Analog Output 1 Low same as Analog Output 1 Low same as Analog Output 1 Low same as Analog Output 1 Low same as Analog Output 1 Low same as Analog Output 1 Low
Analog Input High 1	Measured value program for Analog Input 1 is greater than the user-defined full scale range.
Analog Input High 2 Analog Input High 3 Analog Input High 4	Same as Analog Input 1 High Same as Analog Input 1 High Same as Analog Input 1 High
Analog Input Low 1	Measured value program for Analog Input 1 is lower than the user-defined full scale range.

Table 4-3 Basic Hardware Troubleshooting via Alarms (Continued)

Alarm	Possible Cause
Analog Input Low 2 Analog Input Low 3 Analog Input Low 4	Same as Analog Input 1 Low Same as Analog Input 2 Low Same as Analog Input 3 Low
Preamp Input 1 Out of Range	Indicates either Carrier Gas gone; air not purged from carrier lines; power failure; bad thermistors; preamp out of balance or failed; analyzer temperature low; interconnection wiring.
Preamp Input 2 Out of Range	same as Preamp Input 1 Out of Range
Preamp Input 3 Out of Range	same as Preamp Input 1 Out of Range
Preamp Input 4 Out of Range	same as Preamp Input 1 Out of Range
Preamp Failure	same as Preamp Input 1 Out of Range
Analyzer Failure	Indicates either the Carrier Gas is low or gone; a bad solenoid; a Carrier Gas leak in system.
Power Failure	GC has experienced a re-start since alarms were last cleared, caused by power failure. Automatically starts in RUN mode and runs calibration gas until it identifies all retention times or for a maximum of two hours before switching to line gas.
TCD Fused Peak Overflow - Noisy Baseline	Air not purged from carrier lines; bad thermistors; shields.
RF% Deviation	Calibration gas low or out; valve timing error; faulty auto-calibration solenoid.
Warm Start Calibration Failure	same as RF% deviation
Valve Timing Failure	same as RF% deviation

4.6.2 Troubleshooting Checklist

An online gas chromatograph can operate properly only if flows are balanced and constant, the oven temperature is constant, no leaks are present, and the application settings are correctly timed. Before going through the troubleshooting procedures, perform the routines of the Basic Hardware Troubleshooting via Alarms (see Table 4-3). Checklist records performed regularly may indicate problems and prevent any sudden breakdown.

Open MON2000 in offline mode and select *Logs* → *Parameter List* and open a saved *.par file. Do not adjust any values if they are within the nominal tolerance values on the Checklist. Compare the values with those obtained in preceding weeks. This may pinpoint your problem immediately.

The following is a guide for troubleshooting if a problem with sample analysis occurs. See Table 4-3 for diagnostic data. This data will be useful if it becomes necessary to call Measurement Services for assistance.

Table 4-4 Troubleshooting Checklist

Description	As Found	As Left	Notes
Analyzer			
Leak check with "Snoop" from Carrier Gas bottle to Analyzer regulator.			
Leak check with "Snoop" from calibration standard to auto-calibration solenoid.			
Pre-amp balance voltage	_____mV	_____mV	0 (±0.5 mV)
Sample System			
Leak check with "Snoop" from sample probe to sample solenoid			

Table 4-4 Troubleshooting Checklist (Continued)

Description	As Found	As Left	Notes
Controller Inputs GRI (CH.1) 0.0 - 0.0 GRI (CH.2) 0.8 - 1.2 GRI (CH.3) 0.8 - 1.2 GRI (CH.4) 0.8 - 1.2 Value (16-bit AD) GC 1 GC2 GC3 GC4	 _____ _____ _____ _____	 _____ _____ _____ _____	 -32767 to 32767 -32767 to 32767 -32767 to 32767 -32767 to 32767
Power Supply (DC – DC) Input Voltage Ranges: (24.5V - 26.5VDC) Power Supply (AC – DC) Input Voltage Range: (90–130/180-264 VAC) (Auto-ranging)			**NOTE**: See Figure 4-6 through Figure 4-9 for test point locations. FTB: + 12V @ 0.25A (± 0.6) + 5V @ 3A (± 0.25V) - 3.8V @ 0.1A (± 0.2V) - 12 V @ 0.25A (C 0.6V) Dual Methods Adapter + 20V @ 0.35A (± 1V) - 20V @ 0.35A (± 1V) + 5VDC (± 0.25V) SOL/HTR Driver N/A Output Voltage/Current: 24.0VDC Output Power: Continuous load demand power, measured at the Output Terminals of the Power Supply, **should not** exceed 140 Watts.

Table 4-4 Troubleshooting Checklist (Continued)

Description	As Found	As Left	Notes
Chromatogram Check baseline Check component values on report Number of peaks Retention times Date and file			
Temperature Column Module Temperature Valve Block Temperature Stream Switching System Sample System Temperature	 ____ °C ____ °F ____°C ____°F ____ °C ____ °F ____ °C	 ____°C ____°F ____ °C ____ °F ____ °C ____ °F ____ °C	 79.80 - 80.20 °C 175.64 - 176.36 °F 79.80 - 80.20 °C 175.64 - 176.36 °F 64.0 - 66.0 °C 147.2 - 150.8 °F **
Measure Vent Flow Valve 3 ON Valve 3 OFF	 ___ cc/min ___ cc/min	 ____ cc/min ____ cc/min	 Flow should be as specified on the parameter list for the particular GC .To access this list, open MON2000 and select *Logs → Parameter List*. Check the flow using a portable electronic flow meter or a mechanical flow meter like a Set-a-Flo. If a Rotameter™ is permanently installed it will cause baseline noise.

**Refer to System Operational Parameters

4.6.3 Test Points Dual Methods Board and FTB

This section applies to Model 1000A GCs with TCDs. If your Model 1000A GC is equipped with an FID or FPD, you can skip this section.

Use the test points in Figure 4-6 through Figure 4-9 to ensure that the voltage meets specifications on the dual methods adapter board and the field termination board (see Table 4-4 for voltage specifications).

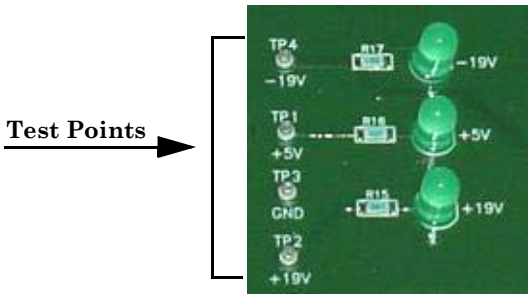


Figure 4-6 Test Points Dual Methods Board (Cut View)

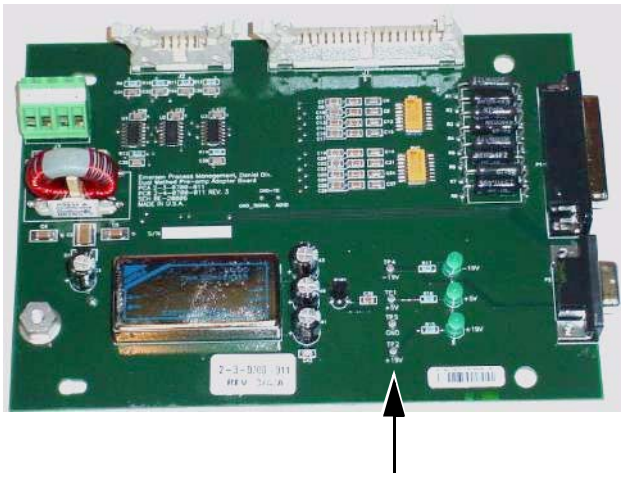


Figure 4-7 Test Points Dual Methods Board

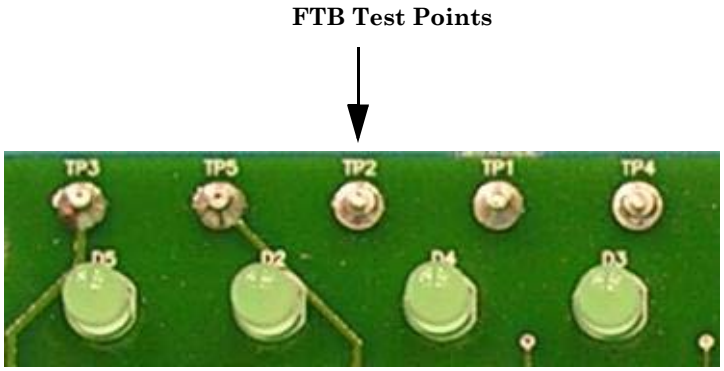


Figure 4-8 Test Points Field Termination Board (Cut View)

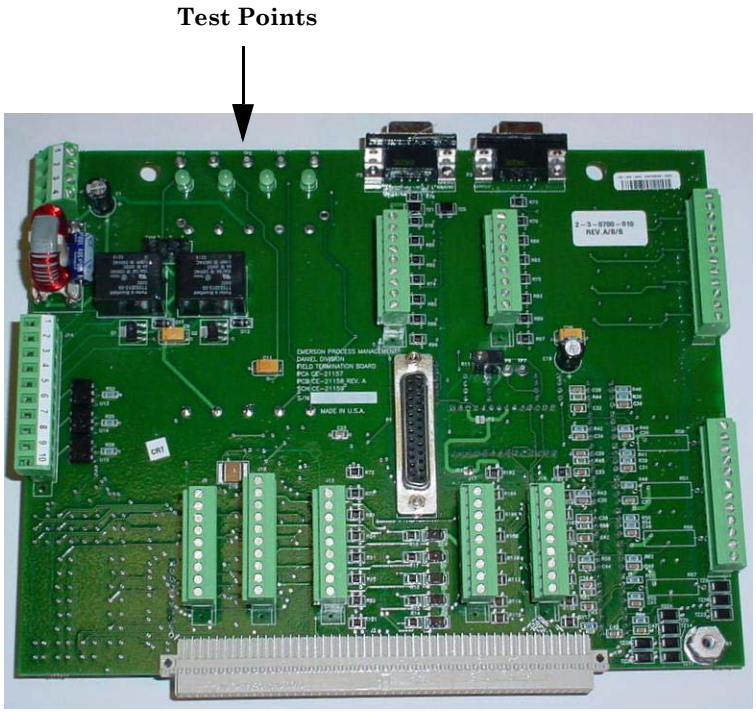


Figure 4-9 Test Points Field Termination Board

4.6.4 Preamplifier

The preamplifier (P/N 3-0580-002) has no parts that may be serviced in the field. If the unit fails, return it to Measurement Services for repair or replacement.

4.6.5 Flow Balance Check

Ensure that the flow panel gauge is properly set. Refer to the Model 1000A Troubleshooting Checklist (see Table 4-4) for values. Do not adjust; check with Measurement Services if your reading is abnormal.

Check the flow at the measure vent and sample vent (see Table 4-4).

4.6.6 Temperature

Use the Temperature Control function for monitoring the temperature of the oven (Detector/s and Columns) and the stream switching block to determine when the Model 1000A is thermally stable. The bottom row labeled Temperature (C) displays the current temperatures.

The settings and values shown in Figure 4-10 and described in Table 4-5 are preset at the factory and are based on the specific customer application. These values should not be changed unless recommended by Application Engineering or Customer Service Personnel, or it is a factory application requirement.

When connected via MON2000, use the *Application* → *Temperature Control* menu path to access this function.

The Temperature Control dialog displays.

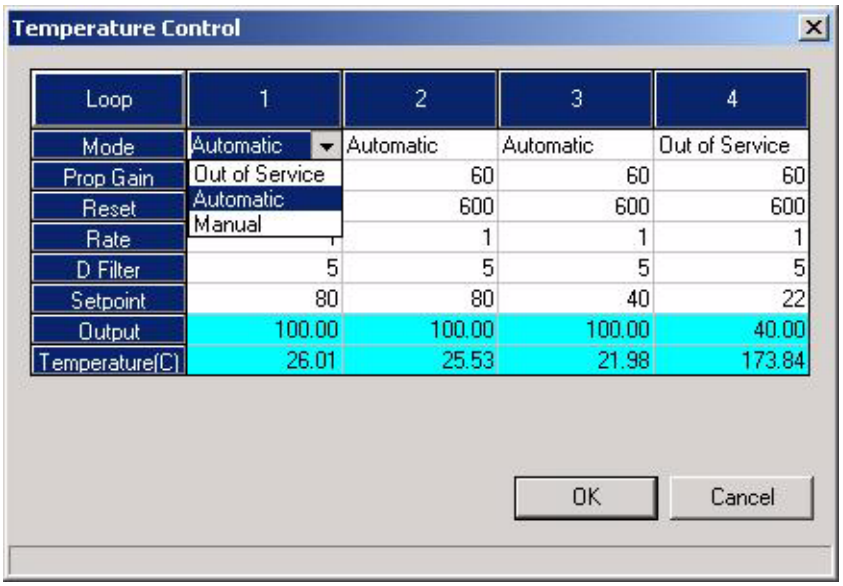


Figure 4-10 Temperature Control Dialog

Use the pull down menu to select the appropriate mode setting (e.g. AUTOMATIC, MANUAL, or OUT OF SERVICE). Ensure that the temperature is constant for the Oven (i.e. Multivalve System block and column module kit) and the SSS.

Columns 1 through 3 (Zones 1-3) have a temperature range of 20 °C to 100 °C (68 °F to 212 °F). Column 4 (Zone 4) has a temperature range of 20 °C to 450 °C (68 °F to 842 °F).

Table 4-5 Temperature Control Dialog

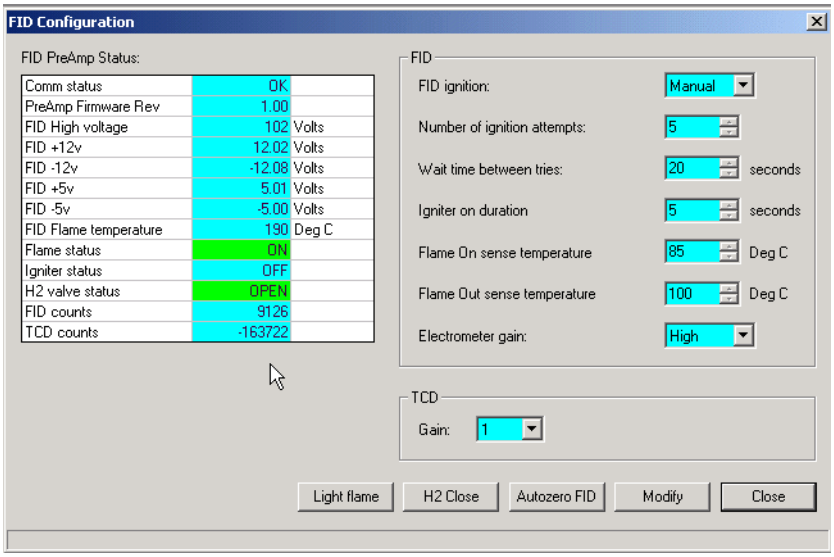
Column	Function	Typical Setting
Column 1	Detector/s or Block Temperature	80 °C (176.0 °F)
Column 2	Air Bath Oven Temperature	80 °C (176.0 °F)
Column 3	Spare	40 °C (104 °F) 60 °C (140 °F)

Table 4-5 Temperature Control Dialog

Column	Function	Typical Setting
Column 4	Spare Or, Methanator Or, LSIV	N/A 300 °C (572 °F) 150 °C (302 °F)

4.6.7 FID Configuration

When connected to the GC via MON2000, use the *Application → FID Configuration* menu to access the FID Configuration dialog. Refer to the MON 2000 *Software for Gas Chromatographs User Manual* (P/N 3-9000-522) for additional configuration details.



Configure the following fields from the FID Configuration dialog:

- FID Ignition - Manual or Automatic
- Number of Ignition attempts
- Wait time between attempts
- Igniter **ON** duration
- Flame **ON** sense temperature Degrees C

- Flame **OUT** sense temperature Degrees C
- Electrometer (TCD) gain

Baseline Drift

To ensure that the baseline is not drifting, compare the baseline upsets caused by valve actuations with those of the spectrum chromatogram provided with the Operational Parameters Sheet.

Ensure that no evidence of component elutions is present when sample is not being injected.

If differences exist between the two spectrum chromatograms, the problem may be due to one or more of the following:

- programming of events
- contamination of the multivalve sealing diaphragms by foreign matter
- improperly adjusted flows
- leaks in the carrier system
- column deterioration due to liquid contamination from a sample
- mis-identifying peaks

A noisy baseline can be caused by carrier leaks, an electronic failure in the preamplifier, a faulty power supply, or defective thermistors in the detector. If the baseline is still noisy after correcting for leaks, perform the Detector Bridge Balance procedure (see Section 4.9) before replacing the detector thermistors or the preamplifier board.

4.7 LEAK CHECKS

4.7.1 Field Service

To perform a field-service leak check of the Model 1000A,

1. Plug all Model 1000A vents.
2. Make sure the setting of the carrier cylinder regulator is 115 psig (pounds per square inch, gauge).

3. Check all fittings at the pressure regulator flow panel and at the carrier cylinder regulator with a leak detector. Correct any leaks detected by a bubble indication.
4. Turn the Carrier Gas shut-off valve clockwise to close. Observe the carrier pressure for ten minutes to check for a drop in carrier pressure.

   The drop should be less than 200 psig on the high side of the regulator/gauge. If the carrier pressure remains constant, no leaks are present.
5. Using MON 2000, manually actuate the valves ON and OFF and observe the pressure with the valves in different positions (see Step 4).

NOTE: When the valves are switched, some pressure change is normal because of carrier loss. Momentarily open the cylinder valve to restore pressure if necessary.

6. If the pressure does not hold constant, check all valve fittings for tightness.
7. Repeat Step 5. If leaks persist, check the valve ports with a commercial gas leak detector.

NOTE: Do not use a liquid leak detector on the valve or components within the MVS insulated cover.

4.7.2 Factory Level Leak Check

This section describes how to perform a factory-level leak check. Before performing the leak check, plug the Measure Vent (labeled “MV”) vent line if it is open. The Sample Vent (labeled “SV”) line should be left open, or unplugged.

The following steps are performed to leak-check the Model 1000A at the factory when the unit is quality-checked prior to release. This procedure is more thorough and is designed to isolate specific zones where a leak may occur.

Leak check the Carrier Gas line first, according to the steps that follow.

1. Purge the valves with Carrier Gas:
   (a) Open the Carrier Gas bottle valve and slowly increase the Carrier Gas feed line pressure to 110 psig, ±2%, with a dual-stage regulator at the Carrier Gas bottle.

NOTE: Do not use the "Carrier Pressure Adjust" valve (on the Flow Panel of the Model 1000A GC) to adjust Carrier Gas line pressure. The valve is factory-set and should not be adjusted.

   (b) Use MON 2000 to manually actuate the valves ON and OFF five times.
2. Pressurize and check the Carrier Gas feed line:
   (a) Set all valves to ON.
   (b) Open the carrier gas bottle valve, and ensure that the carrier gas feed line pressure is 110 psig, ±2%.
   (c) Shut the carrier gas bottle valve.
   (d) Observe the pressure on the high-side regulator gauge of the carrier gas bottle. Because the MV vent line is plugged, the pressure should not decrease in 2 to 3 minutes.
   (e) Set all valves to OFF position.
   (f) Repeat Steps (b) through (d).
   (g) Use MON 2000 to set all valves to AUTO for regular operation.

Next, leak check the calibration gas feed line, per the following steps:

NOTE: Calibration gas line pressure of 50 psig is for leak check and test purposes only. For normal operation, the calibration gas line pressure is maintained at 20-30 psig.

1. Plug the SV vent line.
2. Pressurize the calibration gas line to 50 psig.
   (a) Shut the calibration gas bottle valve.
   (b) Observe the pressure on the high-side regulator gauge of the calibration gas bottle. Because the SV vent line is plugged, the pressure should not decrease in a period of 2 to 3 minutes.

Next, leak check the sample gas lines, per the following steps:

1. Ensure that the Sample valve (SV) vent line is plugged.

   (a) Pressurize the sample gas line to 50 psig or a known pressure.

NOTE: Calibration gas line pressure of 50 psig is for leak check and test purposes only. For normal operation, the calibration gas line pressure is maintained at 20-30 psig.

   (b) Shut off the sample gas.

   (c) Observe the pressure on any gauge that indicates pressure between the closed sample gas block valve and the plugged SV vent line. Because the line is plugged, the pressure should not decrease during a period of 2 to 3 minutes.

2. Leak test all other sample stream lines by connecting gas to each of the sample streams and repeating Step 1(a) through 1(b).

Finish the test and set up the Model 1000A for normal operation, as follows:

1. Using MON 2000, ensure that all valves are set to AUTO.
2. Unplug, or open, the MV and SV vent lines.
3. If the calibration gas bottle was used to leak check the sample stream lines, reconnect the calibration gas bottle to the calibration gas line on the flow panel assembly. Reconnect the sample stream lines.

4.7.3 Plugged Lines, Columns, or Valves

To ensure that lines, columns, and valves are not plugged, check the gas flow at valve ports. For a reference, use the flow diagram in the drawing package, and remember these points about flow diagrams:

- Port-to-port flow paths are indicated by solid or dashed lines.
- A dashed line indicates flow direction when the valve is ON, that is, energized.
- A solid line indicates flow direction when the valve is OFF, i.e., not energized.

- A combination of solid and dashed lines indicates a constant flow path regardless of the ON/OFF state of the valve.

4.8 CHROMATOGRAPH VALVES

Only minimal repair and maintenance is required by the customer (e.g., replacing the diaphragms). Measurement Services recommends returning the oven assembly for major repairs to maintain the validity of the warranty.

4.8.1 Required Tools

The tools required for performing repair and general maintenance on the valve assemblies are:

- Torque wrench, scaled in foot-pounds
- 1/2" socket
- 1/4" open-end wrench
- #1 flat screwdriver

4.8.2 Chromatograph Valve Replacement Parts

Replacement parts required for each of the chromatograph valves on the oven assembly consists of the following parts:

- Diaphragm Kit 6-port Valve (P/N 2-4-0700-187)

Figure 4-11 Chromatograph 6-port Valve Assembly

4.8.3 Valve Cleaning

For cleaning the valve, isopropyl alcohol (P/N 9-9960-111) should be used.

NOTE: Do not use an oil base cleaner on the valve.

4.8.4 Valve Overhaul

The chromatograph valves are designed to withstand millions of actuation cycles without leakage or failure. If normal service is required, the valve can be overhauled using replacement parts available from Measurement Services.

NOTE: Replacement factory-built valves are available. We recommend returning and replacing the 6-port valve for extensive repairs or complete replacement

Use the following procedure for overhauling a 6-port valve:

1. Shut off carrier and sample gas streams entering the unit.

2. Open the door to the lower enclosure to access the valves.
3. Disconnect tubing and fittings that attach to the valve from other locations.

Figure 4-12 TCD Valve Tubing and Fittings

4. Loosen the attaching bolt on the valve to be replaced or serviced (see Figure 4-12).
5. Holding the lower piston plate, pull the valve straight off the block. The alignment pins may stick slightly.

NOTE: Ensure that the primary seal diaphragm is correctly installed on the primary plate.

6. Remove and discard the old valve diaphragms and gaskets. Replace, in the same order, with the new ones supplied.
7. Reinstall the valve using the following steps:

NOTE: Do not scratch the primary plate surface.

(a) Clean the sealing surface as required using Chemwipes with alcohol.

Blow the sealing surface with clean, dry instrument air or Carrier Gas. Dirt including dust and lint can cause troublesome leakage.

NOTE: Do not use an oil base cleaner on the valve.

(b) Align the pins with holes in the block and push the valve assembly into place.

(c) Tighten the valve "attaching bolt" to 30 lbs./ft. (40 N-m)

8. Reconnect all fittings and tubing.

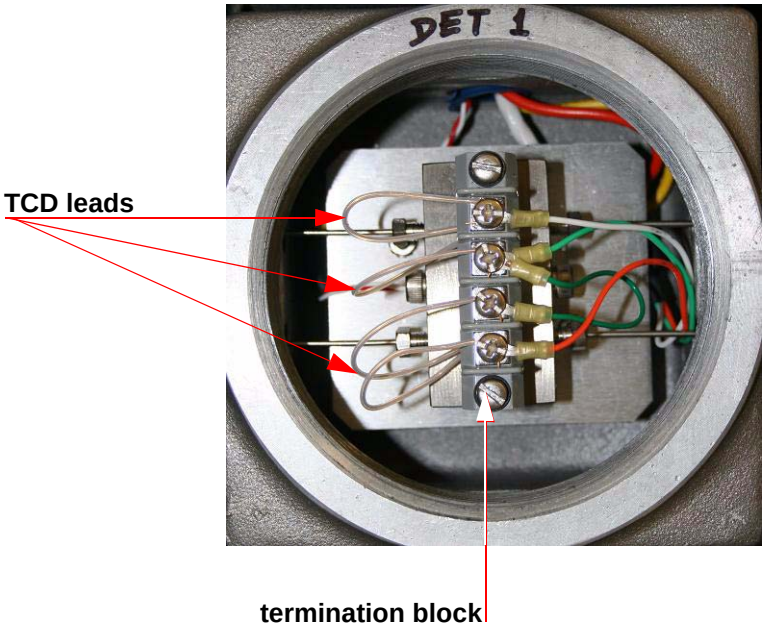
4.8.5 TCD Replacement

WARNING: EQUIPMENT DAMAGE OR PERSONAL INJURY
Disconnect all electrical power to the unit and ensure the area is free of explosive gases. Failure to follow this warning may result in injury or death to personnel or cause damage to the equipment.

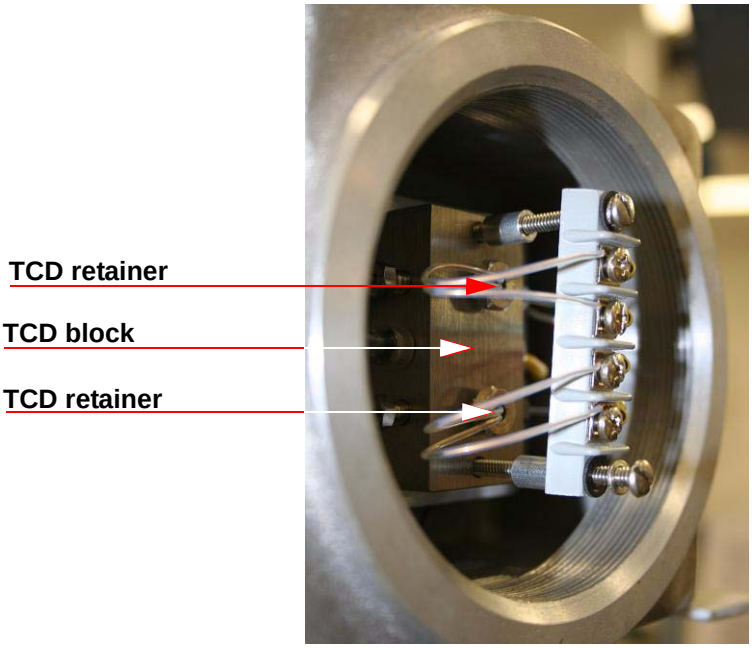
Use the following procedure to replace a detector:

1. Disconnect all power to the unit.
2. Open the door of the lower enclosure to gain access to the TCD housing(s).

3. Unscrew and remove the cover to the housing whose detector you want to replace.
4. Unscrew and release all wire leads from the termination block.



5. Unscrew and remove the two termination block screws located at the top and bottom of the termination block to gain access to the TCD block and retainer nuts.



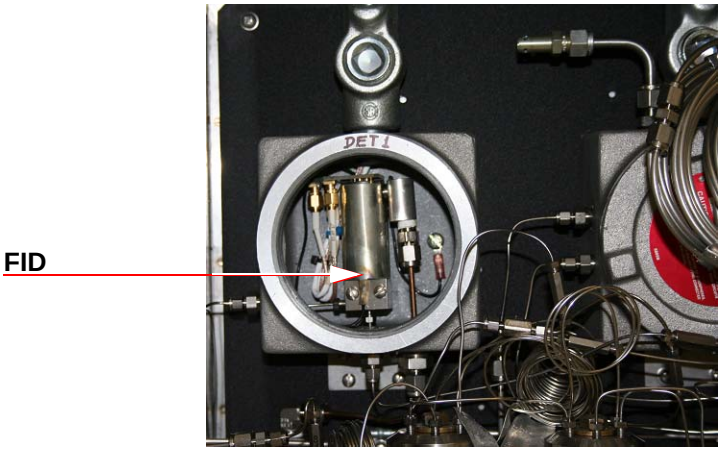
6. The TCD element is held within the TCD retainer nut. To replace the element, do the following:
   (a) Unscrew the retainer nut from the TCD block.
   (b) Remove the old teflon seals, element, and its wires from the retainer nut and insert the new teflon seals and element.
   (c) Screw the retainer nut back into the TCD block.
7. Reconnect all wire leads to the termination block.
8. Use the two termination block screws to return the termination block to its original position over the TCD block.

4.8.6 Micro-FID Removal

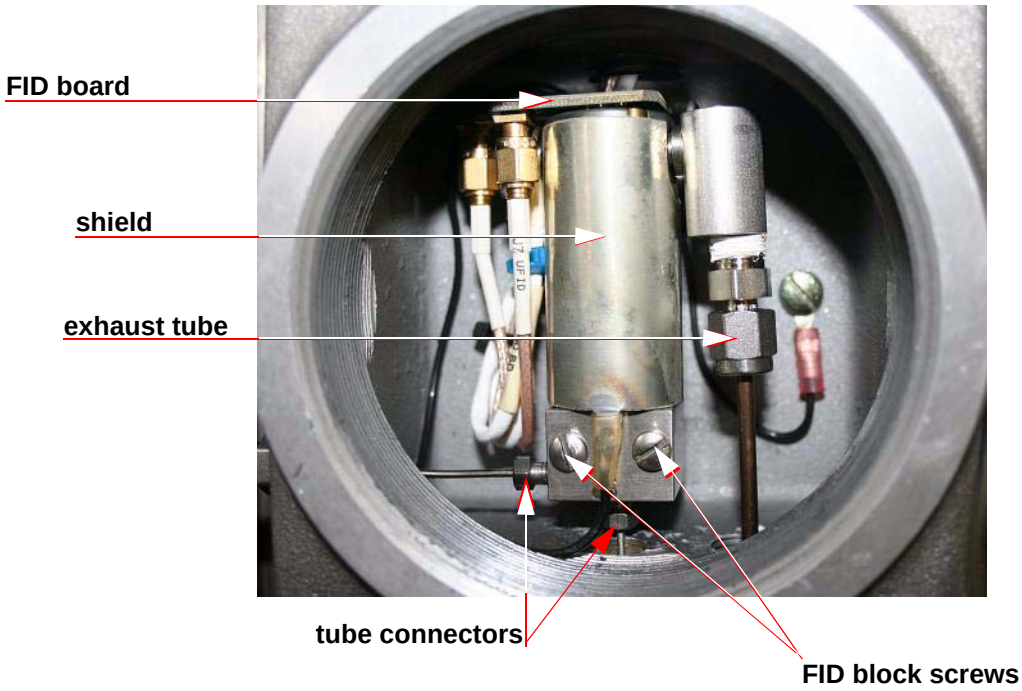
WARNING: EQUIPMENT DAMAGE OR PERSONAL INJURY
Disconnect all electrical power to the unit and ensure the area is free of explosive gases. Failure to follow this warning may result in injury or death to personnel or cause damage to the equipment.

Use the following procedure to remove the FID from the Model 1000A:

1. Disconnect all power to the unit and allow at least 10 minutes for the components to cool-down.
2. Open the door of the lower enclosure to gain access to the FID housing.
3. Unscrew and remove the housing cover to gain access to the FID.



4. Unscrew the tubing connecters located at the bottom of the FID.



5. Unscrew the two FID block screws.
6. Unscrew the FID exhaust tube.
7. Grasp the edges of the FID board on top of the unit and pull and wiggle to remove the six socket tubes that extend onto the pins in the cap.
8. Grasp the shielded section and lift it over the burner. Pull the cap out of the shield. Remove the body from the shield, if necessary.

4.8.7 Micro-FID Maintenance

The FID cap has no replaceable parts. Damage like a broken RTD or broken igniter coil requires a replacement cap.

The burner tip can be removed for cleaning.

1. Loosen the isolating nut one turn.

2. Gently lift out the burner tip tube. Use short needle nose pliers if it is stubborn, taking care not to bend the tube. The alternative is to unscrew the assembly and clean as an assembly.

4.8.8 Micro-FID Re-assembly

1. Insert burner tip tube into the isolating nut. Be certain it is fully seated. There should be about .350" of tube visible.
2. Tighten the isolating nut in small increments until the tube ceases to pull free. Slight additional tightening will ensure proper sealing.
3. Place the cap onto the end of the body with the deep cavity. Once the alignment pin is in its mating hole, gently press the two parts together and ensure the o-ring is seated properly.
4. Slide the FID shield onto the body from the bottom. Align the notch with the exhaust fitting and insert the two screws.
5. Lower the FID body assembly onto the base, placing the alignment pin in its hole. Press the body into place, seating the o-ring. Tighten the screws slightly more than 'finger tight.'
6. Re-connect the ground lead.
7. Press the FID exhaust tube onto the fitting and anchor with the 'U' shaped clip. (1/16" tubing makes an adequate clip.)
8. Plug the FID board onto the cap.

4.9 TCD DETECTOR BRIDGE BALANCE

The following procedure should be performed if the Model 1000A does not produce a chromatogram.

To balance the detector bridge, which is located in the upper enclosure, do the following:

1. Open the door to the upper enclosure to access the preamplifier. It may be necessary to unscrew the two latches that hold the door shut.

Figure 4-13 Model 1000A TCD Preamplifier

2. Attach the negative lead of a digital voltmeter to the black test point (-BRIDGE BALANCE). Attach the positive lead of the digital voltmeter to the red test point (+BRIDGE BALANCE).

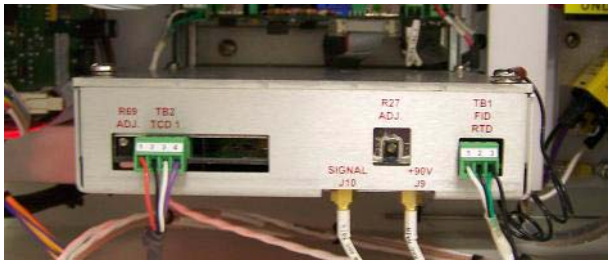


Figure 4-14 Model 1000A Micro-FID Bridge Balance

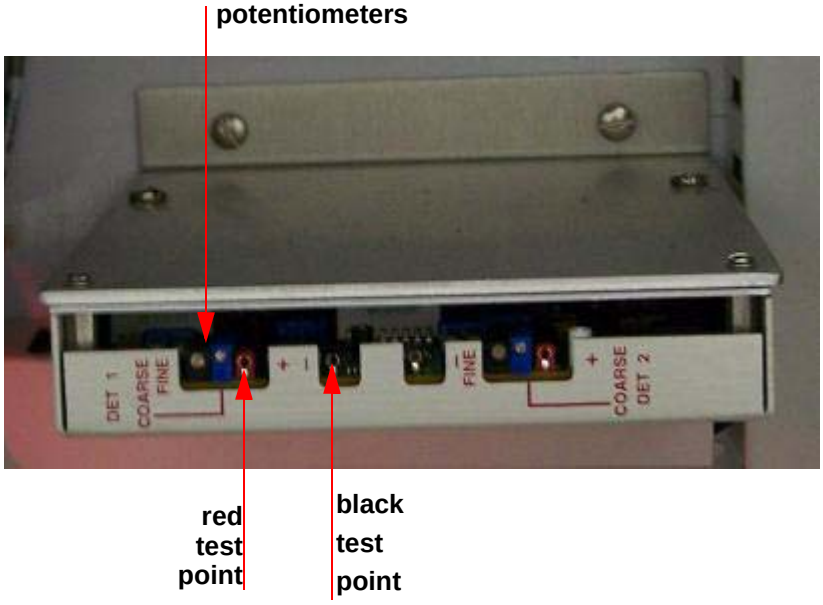


Figure 4-15 Model 1000A TCD Bridge Balance

3. Check the detector bridge voltage. The voltage should read 0 millivolts (mV), ±0.5 mV. To obtain the specified reading, adjust the coarse and fine potentiometers that are located to the left of each red test point.

4.10 MEASURE VENT FLOW

You will need an accurate flow meter for this measurement.

To measure the measure vent flow, proceed as follows:

1. Attach a flow meter to the vent output labeled “Measure Vent 1” on the left side of the Model 1000A’s lower enclosure.

   The flow should measure 12-18 cc/min.

2. Attach a flow meter to the “Measure Vent 2” output.

   The flow should measure 12-18 cc/min.

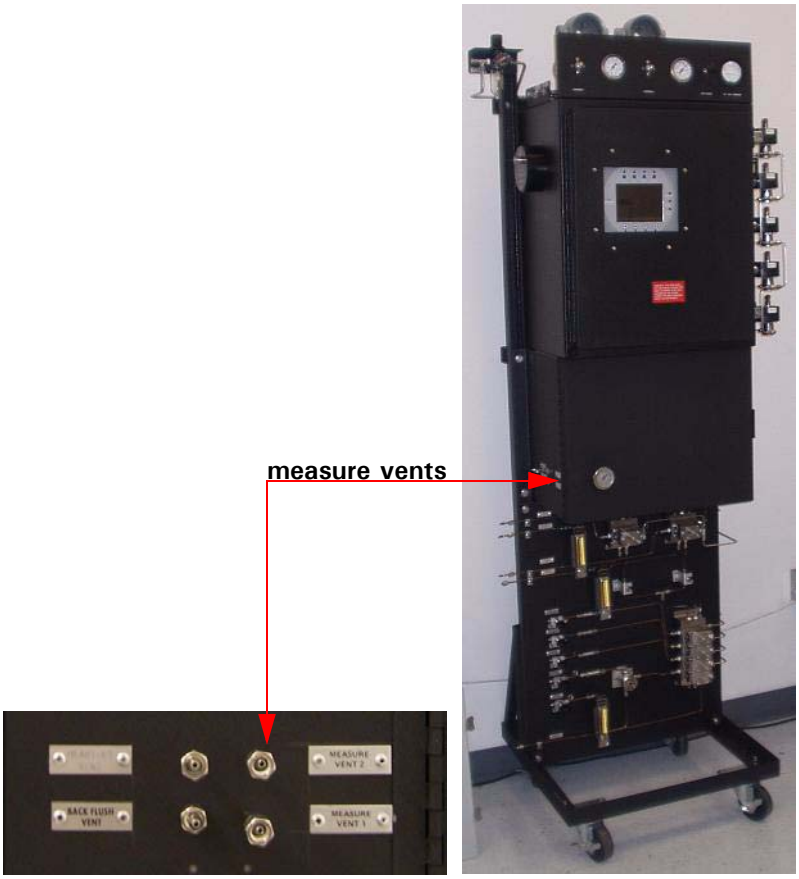


Figure 4-16 Measure Flow Vents

4.11 MODEL 1000A ELECTRICAL COMPONENTS

The Model 1000A GC is designed to operate for long periods of time without need for preventive or regularly scheduled maintenance. The Model 1000A can also be constructed using purged enclosures.

WARNING: EQUIPMENT DAMAGE OR PERSONAL INJURY
Disconnect all electrical power to the unit and ensure the area is free of explosive gases. Failure to follow this warning may result in injury or death to personnel or cause damage to the equipment.

Should there be a need to open the purged enclosure, first disconnect all electrical power to the unit, and ensure the area is free of explosive gases. Prior to opening the Model 1000A, check the operating parameters of the application with a PC using MON 2000 and attempt to isolate or fix any incorrect parameters.

To access the GC electrical components,

1. Ensure electrical power is disconnected from the unit and the environment is safe.

2. Open the electronics enclosure front panel and access the card cage assembly holding the circuit boards.

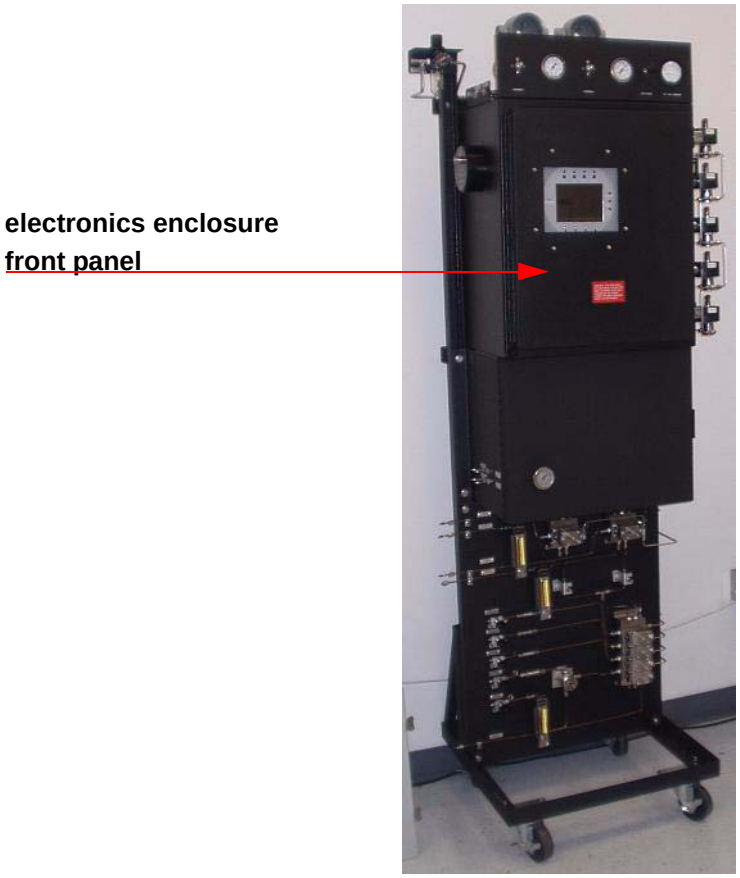


Figure 4-17 Model 1000A Electronics Enclosure

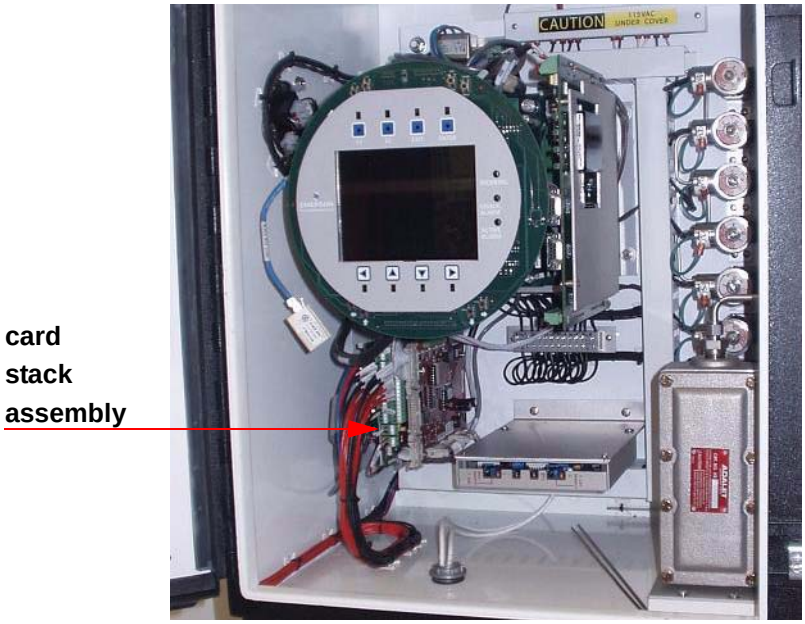


Figure 4-18 Model 1000A Card Stack Assembly

3. Note the location and direction of any board removed. Remove only one end of any cable necessary to obtain access to the desired board. Remember or make note of the cable installation so that the cables can be replaced in the same order. Release the catch(es) and remove/ replace the circuit board(s) as necessary.

NOTE: After removing the cable(s), any board may be replaced without removing the card cage assembly.

4.11.1 DC Power Supply Replacement Procedures

The DC/DC power supply is mounted on the upper back wall of the electronics enclosure (see Figure 4-19) and is accessible by removing the LOI from its housing posts.

WARNING: EQUIPMENT DAMAGE OR PERSONAL INJURY
Disconnect all electrical power to the unit and ensure the area is free of explosive gases. Failure to follow this warning may result in injury or death to personnel or cause damage to the equipment.

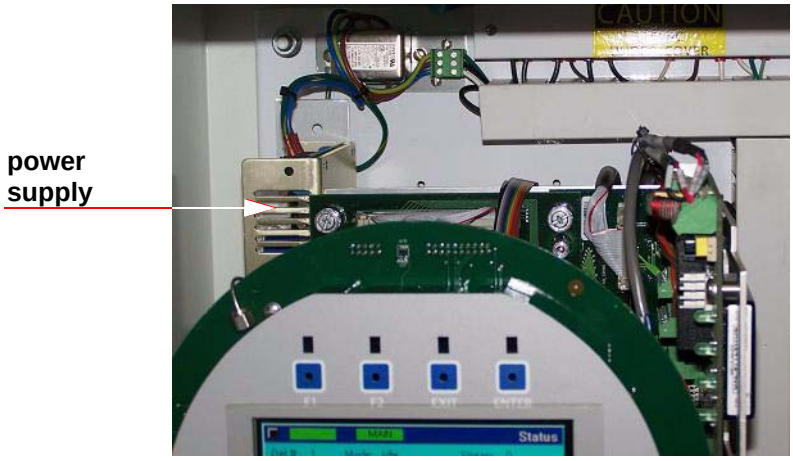


Figure 4-19 DC Power Supply Electronics Enclosure

Tools required to remove and replace the DC power supply:

- Cross point #2 Phillips screw driver (long shank is helpful).
- Head lamp (flashlight)

To remove and replace a faulty DC power supply:

NOTE: Needle nose pliers may be used to turn rear thumbscrews.

1. Disconnect the cables from the CPU, the Com4A board (if installed), the modem board and the Ethernet board (if installed).

2. Unscrew the card cage thumb screws and remove the card cage assembly.
3. Unscrew the two thumb screws on the power supply bracket.
4. Remove the assembly from the unit.
5. Disconnect, label and bundle all leads.
6. Attach all leads to the new DC Power Supply.
7. Align the power supply bracket and tighten the two thumb screws.
8. Reinstall the card cage assembly, tighten the thumb screws and reconnect all cables.
9. Replace the threaded cover plate on the lower enclosure housing.

4.12 COMMUNICATIONS

Model 1000A GC with the TCD

The Model 1000A GC with the TCD has six communications channels available; two communications ports from the WinSystems CPU board (P/N CE-20765) and four communications ports from the optional Com4A board.

NOTE: See Appendix A for a list of the ports and terminals (pins) assigned to serial communications.

Model 1000A GC with the Micro-FID/TCD

The Model 1000A GC with the TCD has two communications channels available; without the Com4A board installed. The Model 1000A, with the Com 4A board installed, has six communications ports available on the FTB; Com1 and Com2, and Com5, Com6, Com7, and Com8.

Com 4 is dedicated to the FID/TCD preamplifier. The LOI uses a video board instead of a serial port connection.

The communication protocols are selected inside the Model 1000A GC with jumpers. The protocols are normally specified by the customer and then set at the factory.

If it becomes necessary to change the communications settings at the site, access to the boards inside the enclosure is required to make changes. See Section 3.4.2 if a communications change becomes necessary.

WARNING: EQUIPMENT DAMAGE OR PERSONAL INJURY
The enclosure should not be opened when hazardous gases are present. Failure to do so may result in injury or death to personnel or cause damage to the equipment.

The jumpers to be changed are located on the WinSystems CPU board and the WinSystems Com4A board.

When the desired Model 1000A GC address (Com ID) is known, it will be set before the unit leaves the factory. If the address (Com ID) needs to be changed in the field, it will be necessary to change the arrangement of an 8-position DIP switch on the multifunction board.

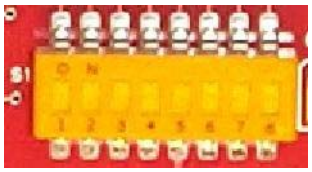


Figure 4-20 Dip Switch

This board is mounted in the card stack assembly beneath the LOI and to the left of the pre-amp.

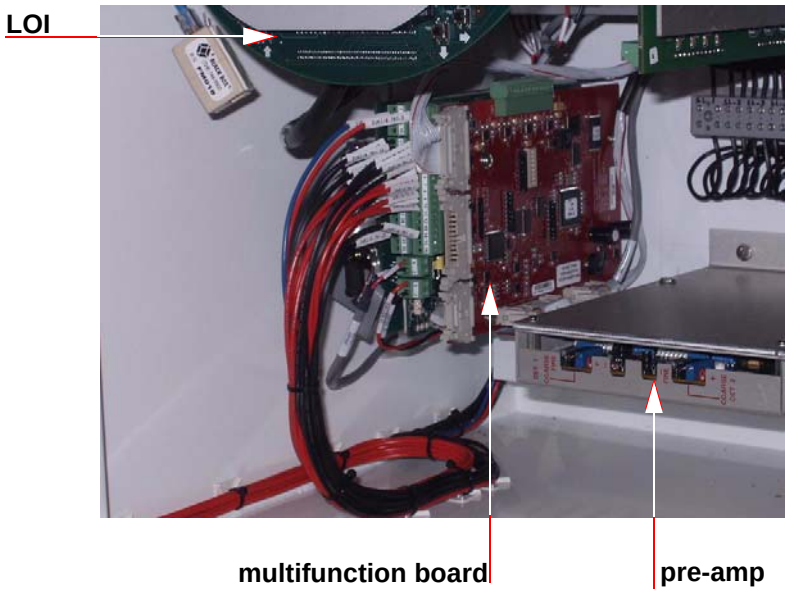


Figure 4-21 Multifunction Board

Ensure the cables are replaced in the exact order and positions.

NOTE: See Section 3.4.1 for an explanation of DIP switch settings and their determination of the Model 1000A Modbus slave address (Com ID).

(a) For example Model 1000A GCs with a TCD,

- Switches "1" through "5" form a 5-bit binary number for setting the Modbus slave address (also known as Com ID or Device ID.)
- Switch number “1” is the least significant bit, and switch number “5” is the most significant bit. Set these switches either ON or OFF.
- Switch "6" is a spare for future use. Switches "7" and "8" are set as needed for the presence of an optional LOI (Local Operator Interface) connected via COM8 (when the COM4A board is installed).

If the COM4A board is not installed, the LOI is connected via COM4. This address should display via the MON 2000 software.

(b) For example Model 1000A GCs with a FID ,

- Switch number “1” is the least significant bit, and switch number “5” is the most significant bit. Set these switches either ON or OFF.
- Switch “6” and “7” are spares and switch “8” is used to cold start the processor (see Table 3-3).

4.13 ANALOG INPUTS/OUTPUTS

The analog outputs can be calibrated or adjusted via MON 2000. However, these outputs should be measured with a good digital meter upon initial installation at zero scale and full scale. Then the span can be set with MON 2000 so that it represents values from zero to 100 percent of the user-defined units in use.

Nominally, calibration is made within a range of 4-20 milliamperes (mA) output from each analog channel. However, zero scale calibrations can be set with 0 mA output, and full scale calibration can be set with up to 22.5 mA output. If there is reason to suspect that the span on any particular channel might be off after a period of time and heavy use, then the analog output for that channel should be recalibrated.

4.13.1 Model 1000A Analog Inputs

There are four analog inputs available on the Field Termination Board (J4 - 12-pin Phoenix connector).

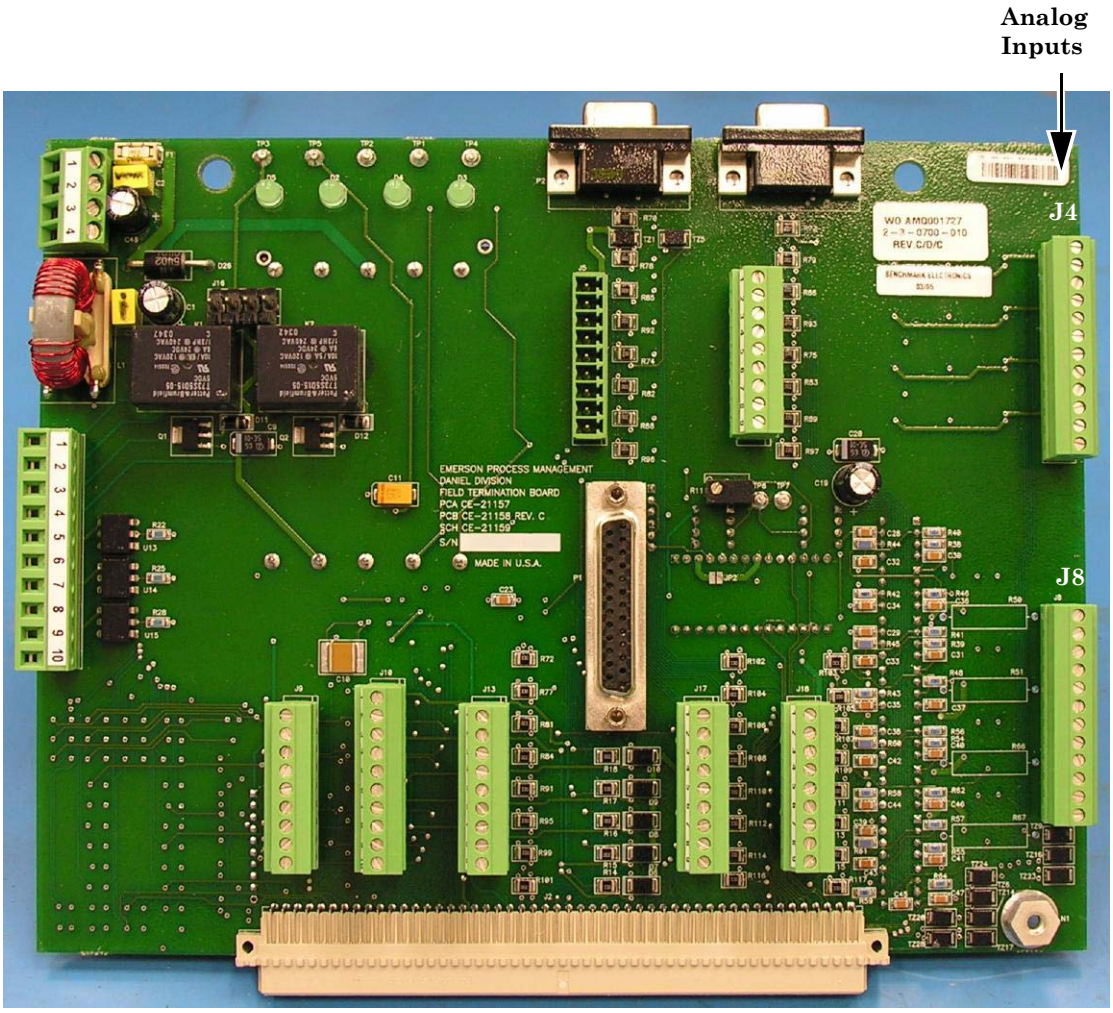


Figure 4-22 Analog Board - Inputs

The Model 1000A analog inputs are configured as follows:

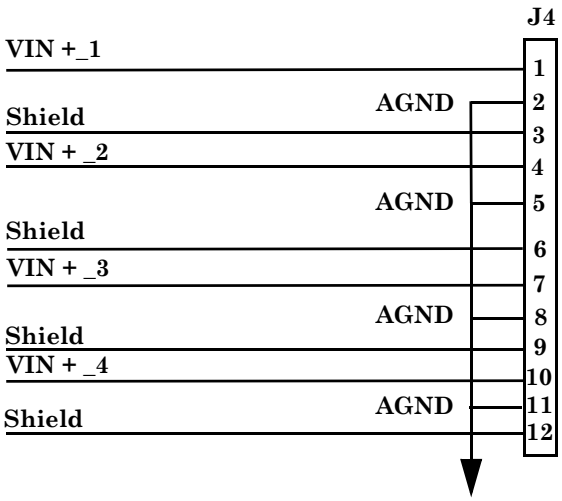


Figure 4-23 Analog Inputs

4.13.2 Analog Output Adjustment

The initial analog output adjustment will be set at the factory, before shipment, at standard values (4-20 mA). It may be necessary to check and/or adjust these values depending on output cabling/impedance. The adjustment may require two persons if the units are some distance apart. It will require a good digital meter to check the zero and full scale values at the receiving end. The scale or span value can be adjusted by a PC with the Model 1000A when the values are known at the receiving end.

It is possible to calibrate the analog outputs using different engineering units, volts and percentages. For examples and detailed instructions, refer to the MON 2000 *Software for Gas Chromatographs Users Manual* (P/N 3-9000-522).

4.13.3 Model 1000A Analog Outputs

Standard Analog Outputs

The Model 1000A has four standard analog outputs (J8 - 12-pin Phoenix connector) on the Field Termination board (P/N 3-0700-010).

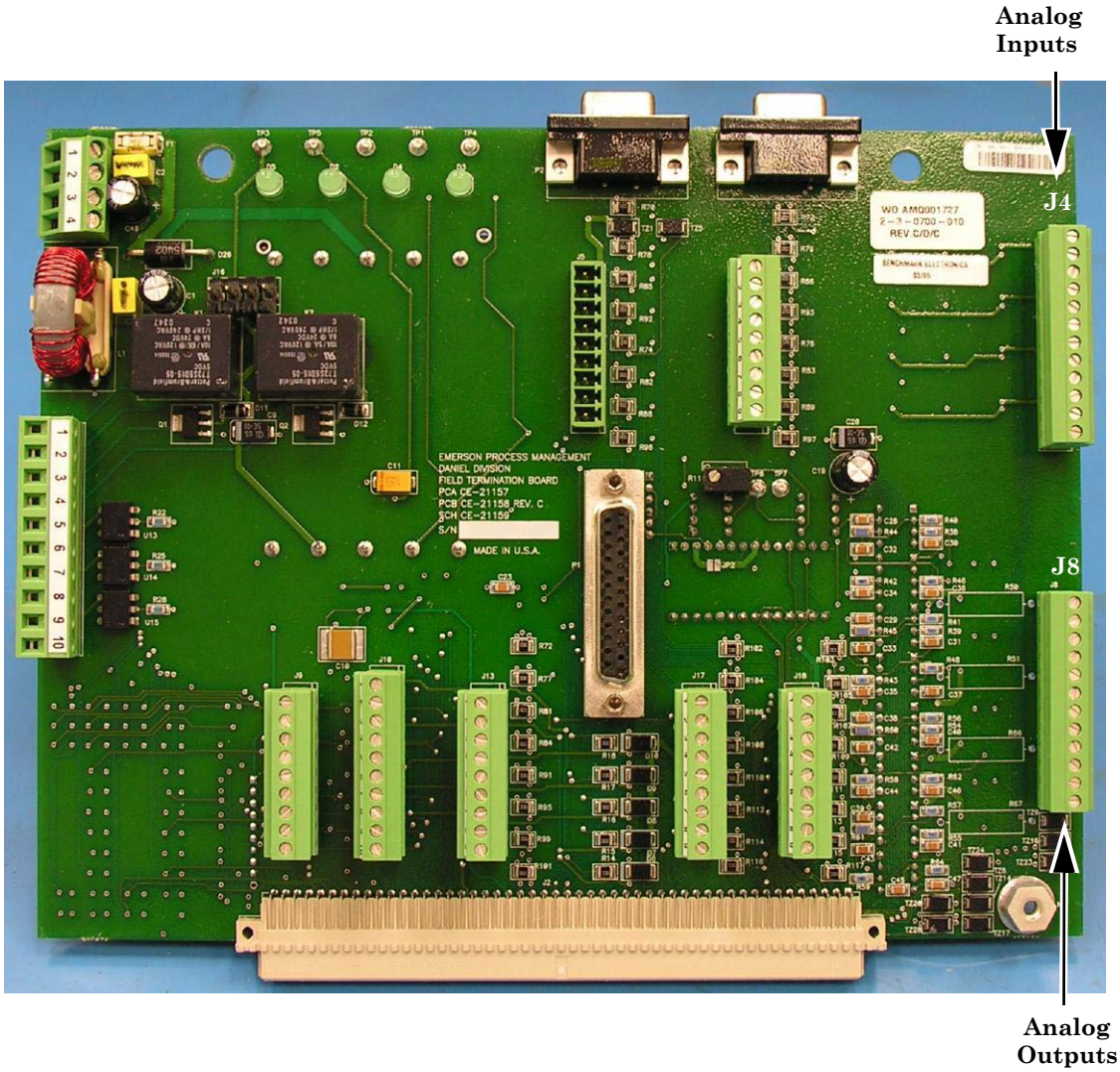


Figure 4-24 FTB Board Analog Outputs

The Model 1000A analog outputs are configured as follows:

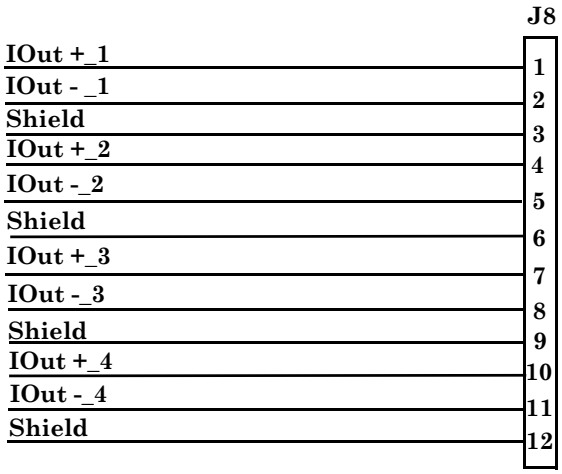


Figure 4-25 Analog Outputs

The analog outputs for the optional analog board (P/N 2-3-0580-037) are configured as follows

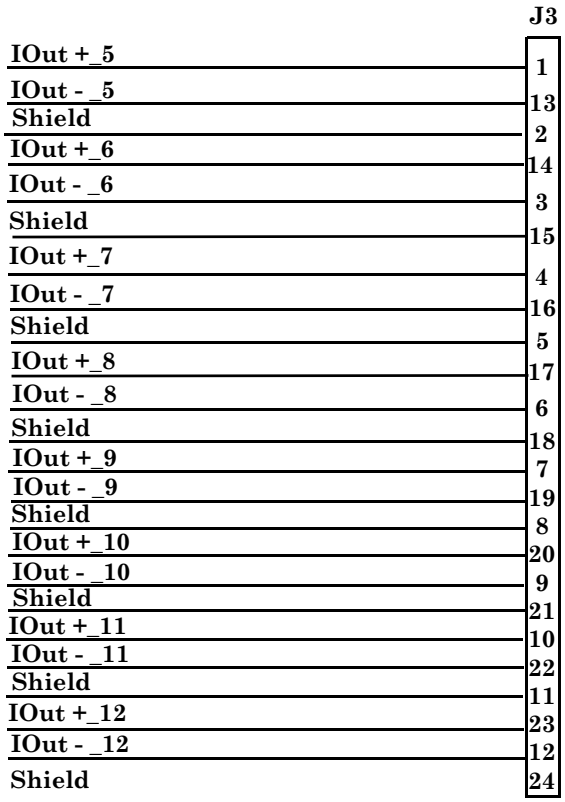


Figure 4-26 Optional Analog Board Outputs

4.14 DISCRETE DIGITAL INPUTS/OUTPUTS

For instructions on connecting digital inputs and outputs to the GC Field Termination Boards, see Section 3.4.8 for more details.

An external loopback test circuit can be built for troubleshooting the Model 1000A digital input/output operation.

4.15 RECOMMENDED SPARE PARTS

See Section 5.1 for the lists of recommended spare parts for approximately one year of maintenance. The quantities represent the number of spares to cover most contingencies at facilities where GC systems are in operation.

Measurement Services offers service and repair service contracts that make maintaining most spares for the GC system unnecessary. Details regarding service contracts may be obtained by contacting Measurement Services at the address or telephone number on the Customer Repair Report in the back of this manual.

4.16 UPGRADE PROCEDURES

4.16.1 Base Operating System

The Base Operating System (BOS) performs functions similar to operating systems such as DOS or Windows® or Linux®.

NOTE: Refer to the *MON2000 Software for Gas Chromatographs User Manual* (P/N 3-9000-522) for BOS upgrade procedures.

BOS provides the basic resources and interfaces to run the user's tasks. Unlike DOS or Windows or Linux, since BOS is an embedded real-time multi-tasking preemptive operating system, there is no direct user level interface to it. If a BOS upgrade is required to your system, refer to the MON 2000 *Software for Gas Chromatographs User Manual* (P/N 3-9000-522) for additional BOS information.

4.16.2 Applications

The GC application, which runs under BOS, utilizes the tools provided by BOS to perform the desired gas chromatograph functions for the user. There are different applications to provide for different gas chromatographic needs. To load a new application or to upgrade an existing application refer to the MON 2000 *Software for Gas Chromatographs User Manual* (P/N 3-9000-522) for details.

RECOMMENDED SPARE PARTS

Following are lists of recommended spares for approximately a year's maintenance of the Model 1000A gas chromatograph. Maximum quantities are the number of spares that is normally adequate to cover most contingencies at facilities where a larger number of Model 1000A systems are in operation. The minimum quantities are the number of spares at facilities with only one to three Model 1000A GCs.

Daniel Measurement Services (DMS), a division of Emerson Process Management, offers service and repair service contracts that make maintaining most spares for the Model 1000A GC unnecessary. Details regarding Daniel Measurement Services' contracts may be obtained by contacting the Daniel Measurement Services' Service Department at the address or telephone number on the Customer Repair Report in the back of this manual.

5.1 ANALYZER SPARES

5.1.1 Printed Circuit Card Assemblies (Analyzer)

Description	Part Number	Maximum	Minimum
Preamplifier board	3-0700-016	1	1
Preamplifier Power Supply board	3-0700-017	1	1
Multifunction board	3-0700-004	1	1
Solenoid/Heater board	3-0700-005	1	1

5.1.2 Electrical and Mechanical Assemblies (Analyzer)

Description	Part Number	Maximum	Minimum
Allenair 4-Way solenoid valve	4-5000-369	1	1
ASCO 3-Way solenoid valve (Auto Cal)	4-5000-075	1	-
ASCO 3-Way solenoid repair kit	4-4000-213	1	1
G.C. valve repair kit (6-port valve)	3-9300-108	3	1
Carrier gas regulator	4-9500-084	1	-
Thermistor seal	6-5000-084	6	6
Thermistor set (9K)	6-1611-083	1	1
185 V Austec LTE185U power supply	5-3200-038	1	1

Description	Part Number
Field Termination Board	3-0700-010
WinSystems CPU Board	CE-20765

APPENDIX A, COMMUNICATIONS SPECIFICATIONS

A.1 TCD SERIAL COMMUNICATIONS

The Model 1000 with a TCD has three standard CPU serial communications ports: Com1, Com2, Com4, and four optional Com4A board serial ports: Com5 Com6, Com7, Com8 and Com9 for the optional internal modem. Per the matrix below, jumper settings can be configured for either RS-232, RS-422, or RS-485 serial signal definitions.

NOTE: Com4 is reserved for the LOI. With the Com4A board installed, Com8 is reserved for the LOI. Com3 is reserved for the multifunction board.

Table A-1 Matrix of Possible TCD Configurations Field Termination Board

Logical Address	Operation	Comments
Com1 and Com2 (WinSys CPU Board) J1 to FTB	RS-232, RS-422 or RS-485	PC, Flow Computer, Modem (external)
Com3 (WinSys CPU Board) J6 to Multifunction Board	RS-232	Reserved for Multifunction Board
Com4 (WinSys CPU Board) J6 to FTB	RS-232, RS-422 or RS-485 (RS-422 and RS-484 needs Chip Kit #CK 75176-2)	
Com5 (WinSys Com4A Board) J9 (9-pin Phoenix)	RS-232, RS-422 or RS-485 (RS-422 and RS-484 needs Chip Kit #CK 75176-2)	Modem (External)
Com6 (WinSys Com4A Board) J13 (9-pin Phoenix)	RS-232, RS-422 or RS-485 (RS-422 and RS-484 needs Chip Kit #CK 75176-2)	
Com7 (WinSys Com4A Board) J17 (9-pin Phoenix)	RS-232, RS-422 or RS-485 (RS-422 and RS-484 needs Chip Kit #CK 75176-2)	
Com8 (WinSys Com4A Board) J18 (9-pin Phoenix)	RS-232, RS-422 or RS-485 (RS-422 and RS-484 needs Chip Kit #CK 75176-2)	
Com9		Reserved for internal modem

A.1.1 Model 1000A with TCD Communications Ports

The WinSystems CPU board has three communications ports that can be used for the PC or the flow computer, as the customer desires.

NOTE: A telephone modem can be connected to any of the GC serial ports configured for RS-232.

If an internal modem (WinSystems, P/N 3-0580-042 or Radicom,P/N 3-0700-029) is installed, it is assigned to serial port Com9.

The four channel WinSystems Com4A board (optional) is installed for applications requiring more than three communications ports. Each channel is individually configured for RS-232, RS-422, or RS-485 (for ports Com5, Com6, Com7, and Com8).

Configuration of each channel requires installing and/or removing the appropriate line driver ICs and installing jumpers. A Chip Kit (P/N CK-75176-2) is used when configuring a single channel for RS-422 mode or when configuring a two channel (maximum) mode for RS-485.

If a modem and a serial controller are both required, an external modem will be assigned to either Com1 or to Com5.

Serial ports configured for RS-232 are most commonly used for direct serial communication between the GC and a PC or modem.

Serial ports configured for RS-422 or RS-485 are most commonly used for long distance serial communications systems, such as a DCS or a network. For these systems, the GC can communicate as a Modbus slave device.

NOTE: In any Modbus *host-slave* DCS or network, there must only be one host to which any one of the GC serial ports can respond as a Modbus slave.

To use MON2000 to configure the GC for Modbus communication, see the *MON2000 Software for Gas Chromatographs User Manual* (P/N 3-9000-522).

For further details, see Figure A-1 through Figure A-3.

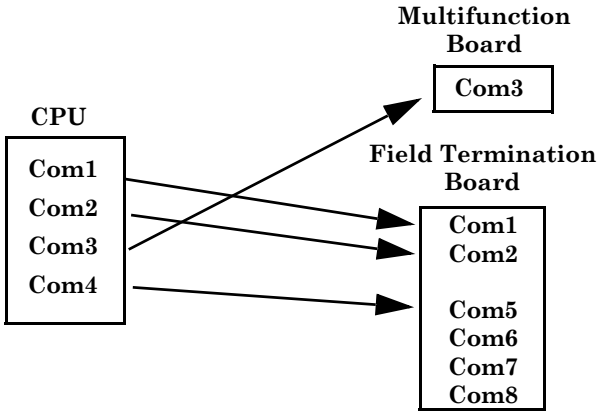


Figure A-1 Standard Configuration without LOI and Com4A Board

NOTE: The standard Model 1000A has three ports available on the FTB: Com1, Com2, and Com5.

NOTE: Model 1000A, with the Com4A board installed, has six communications ports available on the FTB; Com1 and Com2, and Com5, Com6, Com7, and Com8.

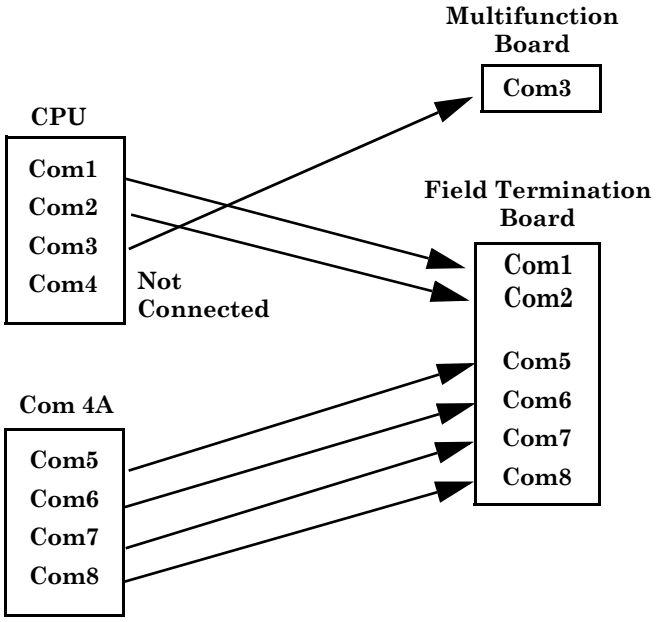


Figure A-2 Configuration with Com4A Board

If using a direct 6-conductor serial cable, connect the exposed cable leads to the FTB serial port. A pinout of a female DB 9-pin socket is shown in Figure A-3.

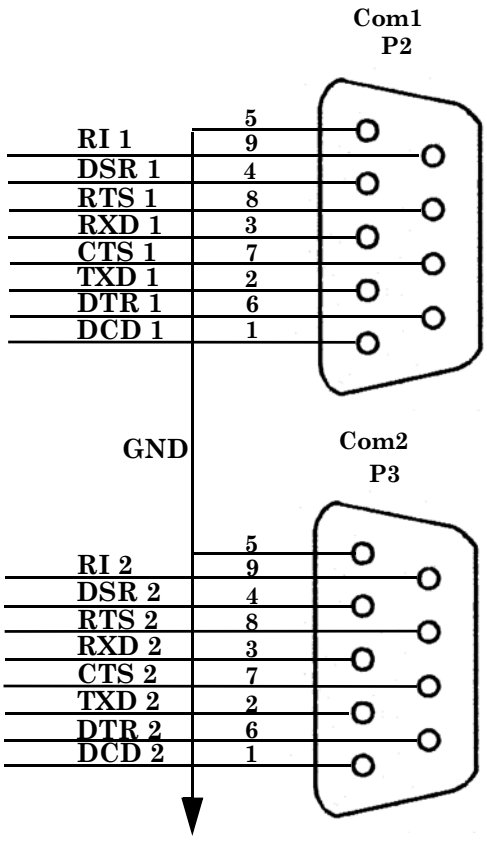


Figure A-3 FTB Com1 and Com2 DB9 Connector

A.2 FID SERIAL COMMUNICATIONS

The Model 1000 with a FID/TCD has two standard WinSystems CPU Board serial communications ports: Com1 and Com2 that can be used for the PC or the Flow Computer, as the customer desires.

NOTE: Com3 is reserved for multifunction board. Com4 is reserved for the FID/TCD board.

The four channel WinSystems Com4A board (optional) is installed for applications requiring more than two communications ports. Each channel is individually configured for RS_232, RS-422 or RS-485 (for ports Com5, Com6, Com7, Com8).

Table A-2 Matrix of Possible FID Configurations Field Termination Board

Logical Address	Operation	Comments
Com1 and Com2 (WinSys CPU Board) J1 to FTB	RS-232, RS-422 or RS-485	PC, Flow Computer, Modem (external)
Com3 (WinSys CPU Board) J6 to Multifunction Board	RS-232	Reserved for Multifunction PCB
Com4 (WinSys CPU Board) J6 to FID/TCD Preamplifier	RS-232	Reserved for FID/TCD Preamplifier PCB
Com5 (WinSys Com4A Board) J9 on FTB (9-pin Phoenix)	RS-232, RS-422 or RS-485 (RS-422 and RS-484 needs Chip Kit #CK 75176-2)	Modem (External)
Com5 (WinSys Com4A Board) J9 on FTB (9-pin Phoenix)	RS-232, RS-422 or RS-485 (RS-422 and RS-484 needs Chip Kit #CK 75176-2)	
Com6 (WinSys CPU Board) J13 on FTB (9-pin Phoenix)	RS-232, RS-422 or RS-485 (RS-422 and RS-484 needs Chip Kit #CK 75176-2)	
Com7 (WinSys Com4A Board) J17 on FTB (9-pin Phoenix)	RS-232, RS-422 or RS-485 (RS-422 and RS-484 needs Chip Kit #CK 75176-2)	
Com8 (WinSys Com4A Board) J18 on FTB (9-pin Phoenix)	RS-232, RS-422 or RS-485 (RS-422 and RS-484 needs Chip Kit #CK 75176-2)	
Com9		Reserved for internal modem

Configuration of each channel requires installing and/or removing the appropriate line driver ICs and installing jumpers. A Chip Kit (P/N CK-75176-2) is used when configuring a single channel for RS-422 mode or when configuring a two channel (maximum) mode for RS-485.

NOTE: In any Modbus *host-slave* DCS or network, there must only be one host to which any one of the GC serial ports can respond as a Modbus slave.

To use MON2000 to configure the GC for Modbus communication, see the *MON2000 Software for Gas Chromatographs User Manual* (P/N 3-9000-522).

If a modem and a serial controller are both required, an external modem will be assigned to either Com1 or to Com5.

Serial ports configured for RS-232 are most commonly used for direct serial communication between the GC and a PC or modem.

Serial ports configured for RS-422 or RS-485 are most commonly used for long distance serial communications systems, such as a DCS or a network. For these systems, the GC can communicate as a Modbus slave device.

For further details, see Figure A-4 and Figure A-5.

NOTE: The standard Model 1000A has two communications ports available on the FTB: Com1 and Com2.

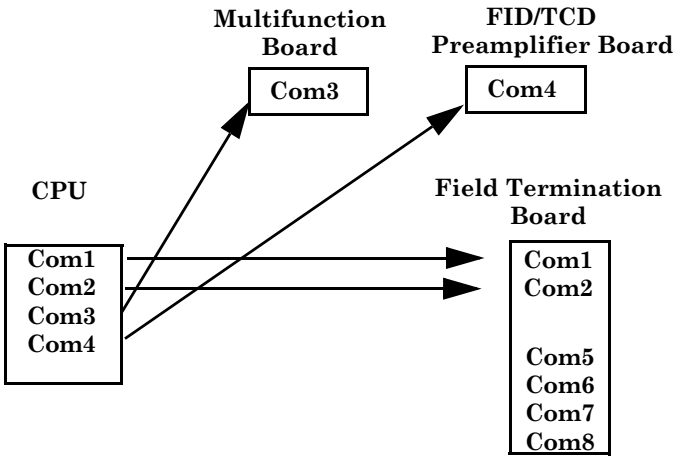


Figure A-4 Configuration without Com4A Board

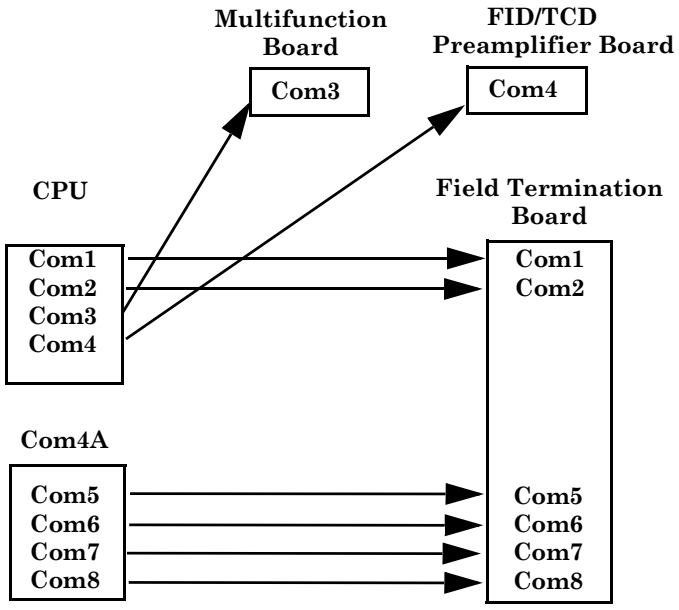


Figure A-5 Configuration with Com4A Board

NOTE: Model 1000A, with an FID and Com 4A board installed, has six communications ports available on the FTB; Com1 and Com2, and Com5, Com6, Com7, and Com8.

A.2.1 Connecting Serial Communications to the GC

To connect serial communications lines to the GC, do the following:

NOTE: Serial communications for FTB (Com1 - Com4) is standard. Com3 is reserved for the multifunction board. Serial communications with optional Com4A board are available on ports Com5 - Com8.

1. Access the FTB in the lower enclosure.
2. Route serial communications lines appropriately.
3. Make serial communications line connections to the FTB. See Section A.1.1 for port numbers and pinouts.

Each of the various combinations available for GC serial communications ports (i.e., RS-232, RS-422, or RS-485) require specific jumper settings on the WinSystems CPU board or the optional Com4A board.

In most instances, installation of these jumper settings *requires no modification*. Configurations have been performed at the factory prior to shipment of the Model 1000, according to customer specifications for serial communications.

NOTE: If you are changing or adding serial communications to the GC, ensure that the correct jumpers are set.

RS-232 Ports

See Appendix A.2.2 for RS-232 port connections

Voltage: ±5 volts or ±12 volts, depending on jumper settings

Recommended Maximum Cable Length: 50 feet (15 meters)

Pinouts: See Appendix A.2.2

RS-422 Ports

See Appendix A.2.2 for RS-422 port connections.

Voltage: line drivers meet Electronics Industries Association (EIA) specifications for RS-422.

Recommended Maximum Cable Length: 4000 feet (1219 meters)

Pinouts: See Appendix A.2.2

RS-485 Serial Specifications

See Appendix A.2.2 for RS-485 port connections.

Voltage: line drivers meet Electronics Industries Association (EIA) specifications for RS-485

Recommended Maximum Cable Length: 4000 feet (1219 meters)

Pinouts: See Appendix A.2.2

A.2.2 FTB Serial Communications

The settings are shown in Figure A-6 through Figure A-11.

Com1

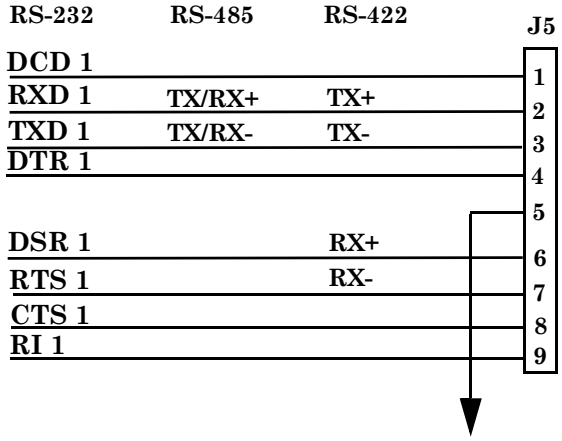


Figure A-6 FTB Com1 DB 9-pin Phoenix Connector

Com2

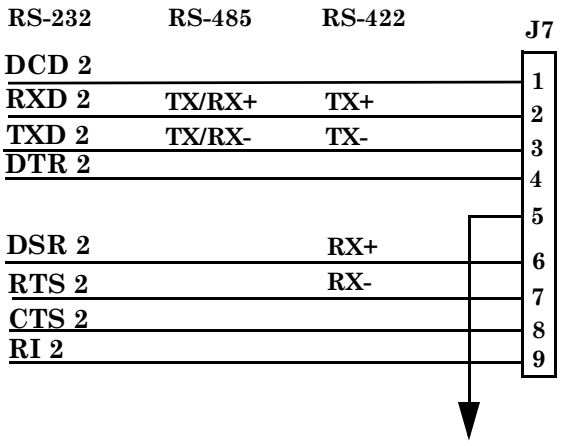


Figure A-7 FTB Com2 DB 9-pin Phoenix Connector

Com5

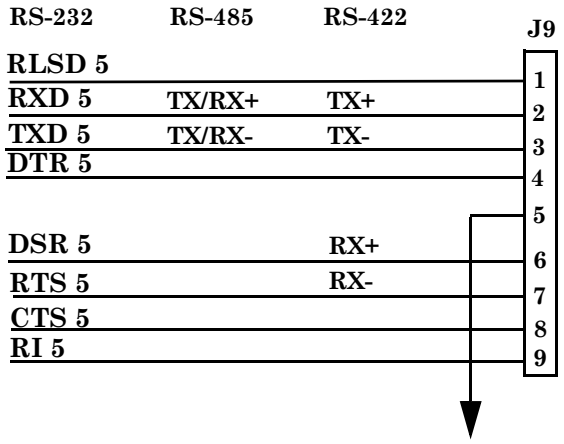


Figure A-8 FTB Com5 DB 9-pin Phoenix Connector

Com6

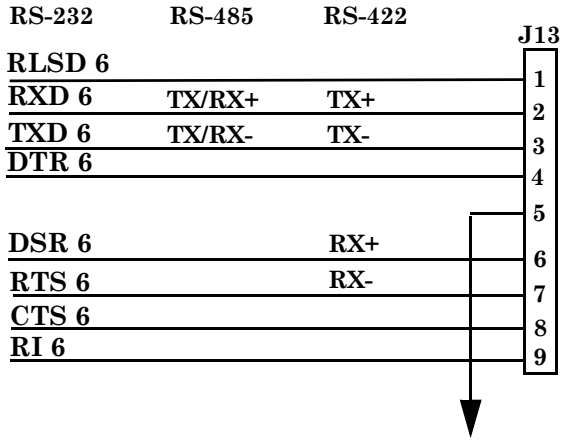


Figure A-9 FTB Com6 DB 9-pin Phoenix Connector

Com7

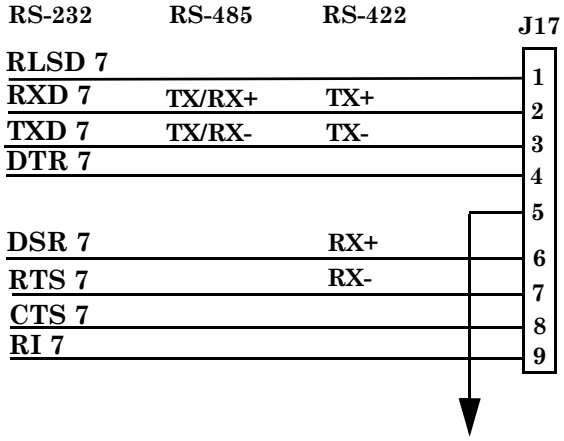


Figure A-10 FTB Com7 DB 9-pin Phoenix Connector

Com8

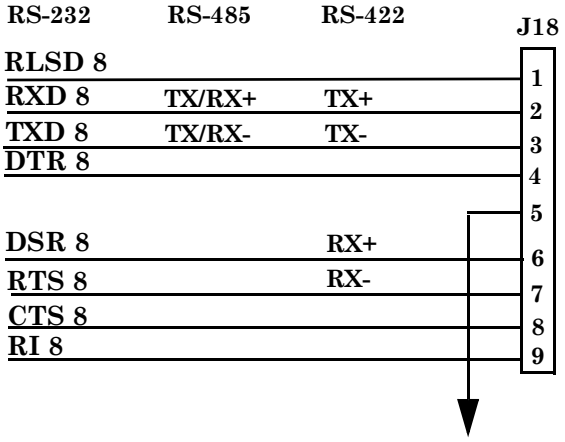


Figure A-11 FTB Com8 DB 9-pin Phoenix Connector

WinSystems CPU

Jumper settings and pinouts for the four WinSystems CPU board serial communications ports; Com1, Com2, Com3, and Com4 are defined in the following tables.

Table A-3 Communication with WinSystems CPU

Com1
RS-232 Mode
J8 – Jumpers Pins 1 and 2 J13 – No jumpers U2 – Installed (Standard) U5 – Removed U6 – Removed
RS-422 Mode (Need WinSys Chip Kit CK # 75176-2)
J8 – Jumper Pins 1 and 2 J13 – No jumpers U2 – Removed U5 – Installed U6 – Installed
RS-485 Mode (Need WinSys Chip Kit CK # 75176-2)
J8 – Jumper Pins 1 and 2 J13 – Jumper Pins 2 and 3 U2 – Removed U5 – Removed U6 – Installed

Table A-4 Communication with WinSystems CPU

Com2
RS-232 Mode
J9 – Jumpers Pins 1 and 2 J16 – No jumpers U9 – Installed (Standard) U11 – Removed U12 – Removed
RS-422 Mode (Need WinSys Chip Kit CK # 75176-2)
J9 – Jumper Pins 1 and 2 J16 – No jumpers U9 – Removed U11 – Installed U12 – Installed
RS-485 Mode (Need WinSys Chip Kit CK # 75176-2)
J9 – Jumper Pins 1 and 2 J16 – Jumper pin 2 and 3 U9 – Removed U11 – Removed U12 – Installed

Table A-5 Communication with WinSystems CPU

Com3 Reserved for Multifunction Board
RS-232 Mode
J12 – Jumpers Pins 1 and 2
J14 – No jumpers
U4 – Installed (Standard)
U7 – Removed
U8 – Removed

Table A-6 Communication with WinSystems CPU

Com4 (Reserved for FID/TCD Preamplifier Board)
RS-232 Mode
J15 – Jumpers Pins 1 and 2
J17 – No jumpers
U10 – Installed (Standard)
U13 – Removed
U14 – Removed
RS-422 Mode (Need WinSys Chip Kit CK # 75176-2)
J15 – Jumpers Pins 1 and 2
J17 – No jumpers
U10 – Removed
U13 – Installed
U14 – Installed

Table A-6 Communication with WinSystems CPU

Com4 (Reserved for FID/TCD Preamplifier Board)
RS-485 Mode (Need WinSys Chip Kit CK # 75176-2)
J15 – Jumpers Pins 1 and 2
J17 – Jumpers Pins 2 and 3
U10 – Removed
U13 – Removed
U14 – Installed

WinSystems MCM/LPM – Com4A Board Jumper settings and pinouts for the four WinSystems Com4A board (optional) serial communications ports; Com5, Com6, Com7, and Com8 are defined in the following tables.

Table A-7 Communication with WinSystems MCM/LPM – Com4A Board (Optional)

Com5
RS-232 Mode
J2 – No jumpers
U6 – Installed (Standard)
U3 – Removed
U4 – Removed
RS-422 Mode (Need WinSys Chip Kit CK # 75176-2)
J2 – No jumpers
U6 – Removed
U3 – Installed
U4 – Installed
RS-485 Mode (Need WinSys Chip Kit CK # 75176-2)
J2 – Jumper Pins 2 and 3

Table A-7 Communication with WinSystems MCM/LPM – Com4A Board (Optional)

Com5

U6 – Removed

U3 – Removed

U4 – Installed

Com6

RS-232 Mode
J5 – No jumpers U13 – Installed (Standard) U10 – Removed U14 – Removed
RS-422 Mode (Need WinSys Chip Kit CK # 75176-2)
J5 – No jumpers U13 – Removed U10 – Installed U14 – Installed
RS-485 Mode (Need WinSys Chip Kit CK # 75176-2)
J5 – Jumper pins 2 and 3 U13 – Removed U10 – Removed U14 – Installed

Com7
RS-232 Mode
J4 – No jumper U11 – Installed (Standard) U9 – Removed U12 – Removed
RS-422 Mode (Need WinSys Chip Kit CK # 75176-2)
J4 – No jumpers U11 – Removed U9 – Installed U12 – Installed
RS-485 Mode (Need WinSys Chip Kit CK # 75176-2)
J4 – Jumper pins 2 and 3 U11 – Removed U9– Removed U12 – Installed

Com8
RS-232 Mode
J1 – No jumpers U5 – Installed (Standard) U1 – Removed U2 – Removed

Com8
RS-422 Mode (Need WinSys Chip Kit CK # 75176-2)
J1 – No jumpers
U5 – Removed
U1 – Installed
U2 – Installed
RS-485 Mode (Need WinSys Chip Kit CK # 75176-2)
J1 – Jumper pins 2 and 3
U5 – Removed
U1 – Removed
U2 – Installed

Com4A Board Compatibility Settings

Table A-8 J10 Jumper Settings

Pin(s)	Position
1 and 2	In
3 and 4	In
7 and 8	In
9 and 10	In

Table A-9 J7 Jumper Settings

Pin(s)	Position
1 and 2	Open
3 and 4	Open
5 and 6	Open

Table A-10 J8 Jumper Settings

Pin(s)	Position
1 and 2	In
3 and 4	In
5 and 6	In
7 and 8	In

Table A-11 J9 Jumper Settings

Pin(s)	Position
1 and 2	In
5 and 6	In

WinSystems Ethernet Board

The PCM-NE2000-16 PC-104 can be configured by using the on-board jumper block.

Jumper settings and pinouts used on the Model 1000 for the PCM-NE-2000-16 PC-104 Ethernet board (optional) are defined in the following table:

Table A-12 Ethernet Board Pin Settings

Jumper	Pin Position "In"
J1	13 and 14 15 and 16 17 and 18 23 and 24 27 and 28
J2	1 and 2
J3	1 and 2

Radicom 56K Baud Modem Board

The jumper settings and pinouts for the Radicom Modem (P/N 3-0700-029) are shown below: (see Section 3.4.11).

Table A-13 J26 Radicom Modem Jumper Settings

Pin(s)	Position
1 and 2	In

Table A-14 J27 Radicom Modem Jumper Settings

Pin(s)	Position
1 and 2	In

Table A-15 J30 Radicom Modem Jumper Settings

Pin(s)	Position
1 and 2	In

Table A-16 J31 Radicom Modem Jumper Settings

Pin(s)	Position
2 and 3	In

A.3 WIRING LOCAL RS-232 COMMUNICATIONS

A.3.1 GC Serial Port and Cable Configurations

This section provides more detailed information about local serial port connections for the Model 1000A. It identifies serial port pin assignments and diagrams for designing RS-232 serial cables.

GC serial ports are found on the Field Termination Board and the connection points for external devices are as follows:

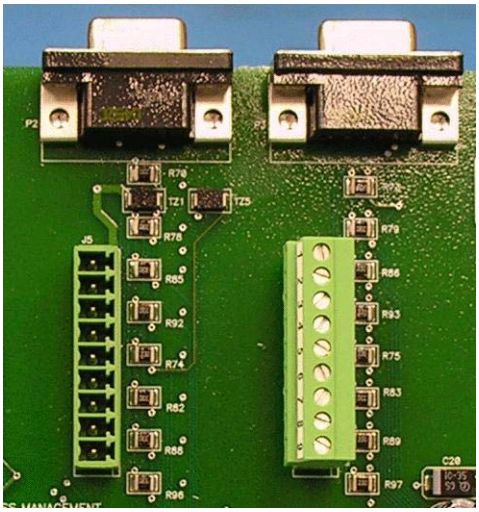


Figure A-12 FTB Serial Connections

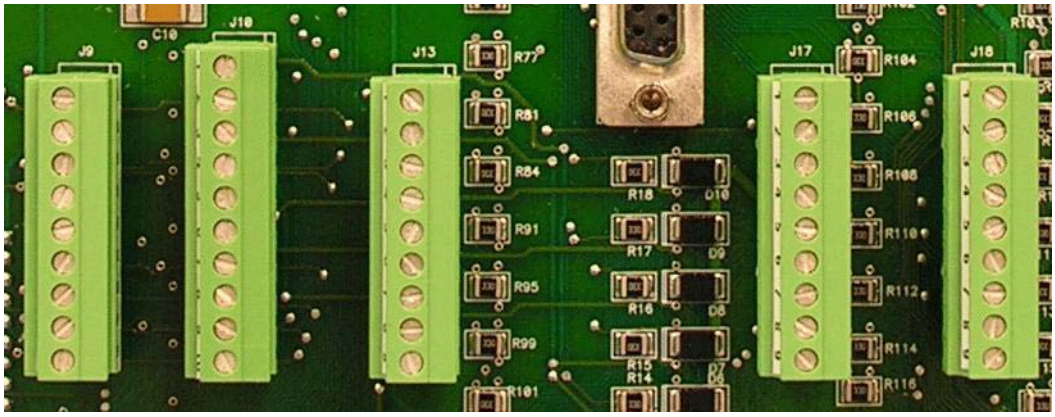


Figure A-13 FTB Serial Connections

Table A-17 Serial Ports on Field Termination Board

Port	Comments	Phoenix Plug (bare-wire) connection
Serial Port 1 (Com1)	P2 DB 9-pin Connection	J5
Serial Port 2 (Com2)	P3 DB 9-pin Connection	J7
Serial Port 3 (Com3)	Reserved for Multifunction Board	N/A
Serial Port 4 (Com4)	Reserved for FID/TCD Preamplifier Board (FID/TCD units)	N/A
Serial Port 5 (Com5)		J9
Serial Port 6 (Com6)		J13
Serial Port 7 (Com7)		J17
Serial Port 8 (Com8)		J18

Phoenix plug (bare-wire) connections are available to all four serial ports. Pin-outs are identical for all four serial port Phoenix plugs and jacks. Each Phoenix plug/jack (male) combination allows a bare-wire connection and uses 9-Pins as illustrated:

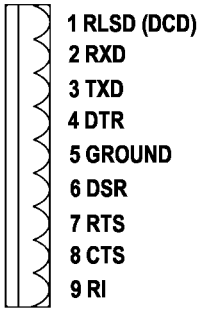


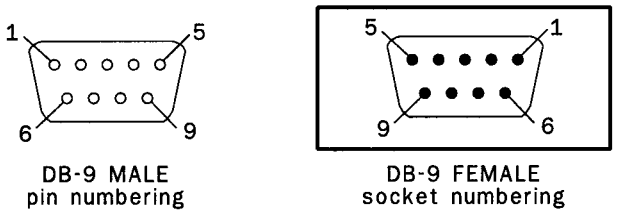
Figure A-14 Phoenix Connector (J5, J6, J10, and J11) Pinout

Null modem connections (DB 9-pin) are available for Serial Ports 1 and 2 only, as noted in Table A-17.

NOTE: PC-to-GC connections, direct serial:
The GC serial ports were wired to appear as DCE, so a straight-through serial cable is used for a direct serial connection between the GC and the PC. (The PC is Data Terminal Equipment, or DTE.) See Section A.3.2.

External modem-to-GC connections, serial: a null modem cable and gender changes may be purchased from any computer products store, for the GC to external modem connection. However, a custom serial cable may be built to emulate a null-modem cable for a connection between the GC Controller and an external modem. (The modem is Data Communications Equipment, or DCE.) See Section A.4.

Both of the GC DB 9-pin jacks are female and have identical pin assignments. Note that a DB 9-pin male numbering scheme is also illustrated, but for reference purposes only as follows (see Figure A-15).



pinout for both DB-9 female jacks at GC Controller

5	4	3	2	1
GND	DSR	RxD	TxD	RLSD
9	8	7	6	
RI	RTS	CTS	DTR	

Figure A-15 DB 9-pin Connector (P2 and P3) and Pinout for Jacks

A.3.2 GC DB 9-pin Serial Port to PC DB 9-pin Port

To make an RS-232 serial connection between one of the DB 9-pin serial ports of the GC, and a PC with DB 9-pin serial port, use a straight-through serial cable, terminated as DB 9-pin male / DB 9-pin female. This will work if the PC has a male DB 9-pin serial port, and its pin

assignments are identical to those found on a typical DB 9-pin serial port of an IBM PC.

The straight-through serial cable can be obtained from most computer products suppliers, so custom-building a cable normally is not necessary. Wiring and signal paths are illustrated as follows (see Figure A-16).

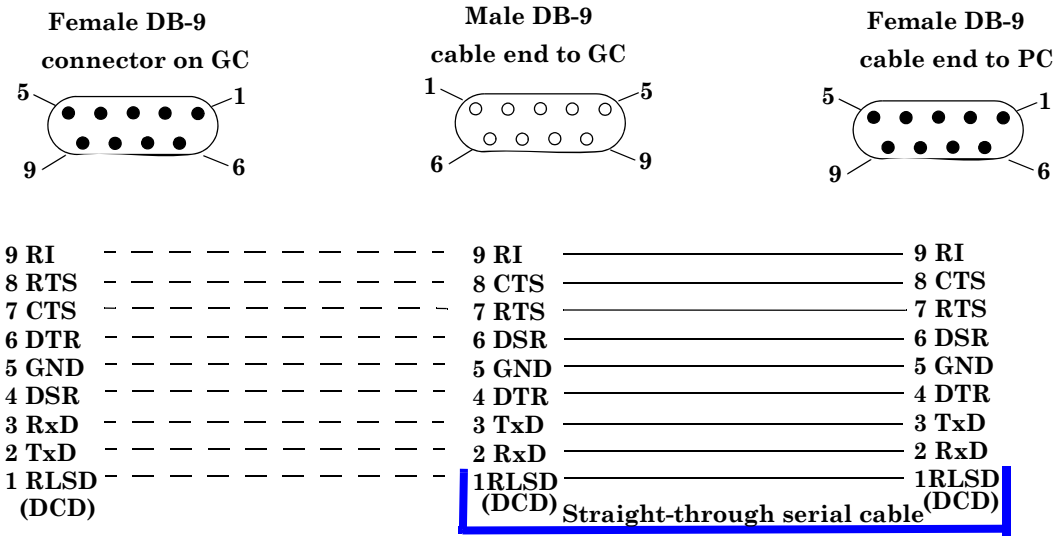


Figure A-16 GC DB 9-pin Port to PC DB 9-pin Port

A.3.3 GC DB 9-pin Serial Port to PC DB 25-pin Port

To make an RS-232 serial connection between one of the DB 9-pin serial ports of the GC, and a PC with DB 25-pin serial port, you may be able to use a straight-through serial cable, terminated as DB 9-pin male / DB 25-pin female. This will work if the PC has a male
DB 25-pin serial port, and its pin assignments are identical to those found on an IBM PC.

The necessary straight-through serial cable can be obtained from most computer products suppliers, so custom-building a cable normally is not necessary. Wiring and signal path are illustrated as follows (see Figure A-17).

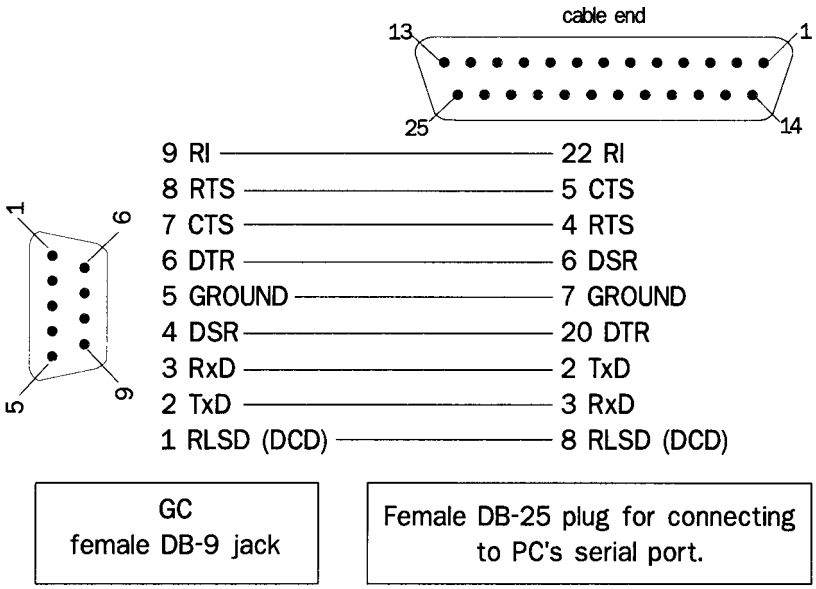


Figure A-17 GC DB 9-pin Port to PC DB 25-pin Port

A.3.4 GC PHOENIX Plug Port to PC DB 9-pin Port

To make an RS-232 serial connection between one of the Phoenix Plug serial ports of the GC, and a PC with DB 9-pin serial port, you will need to manufacture the cable and its DB 9-pin, female plug cable end as illustrated below (see Figure A-18).

NOTE: The cable (P/N 3-2350-068) for this application is also available in a customer-specified length with six exposed leads and a female DB 9-pin connector.

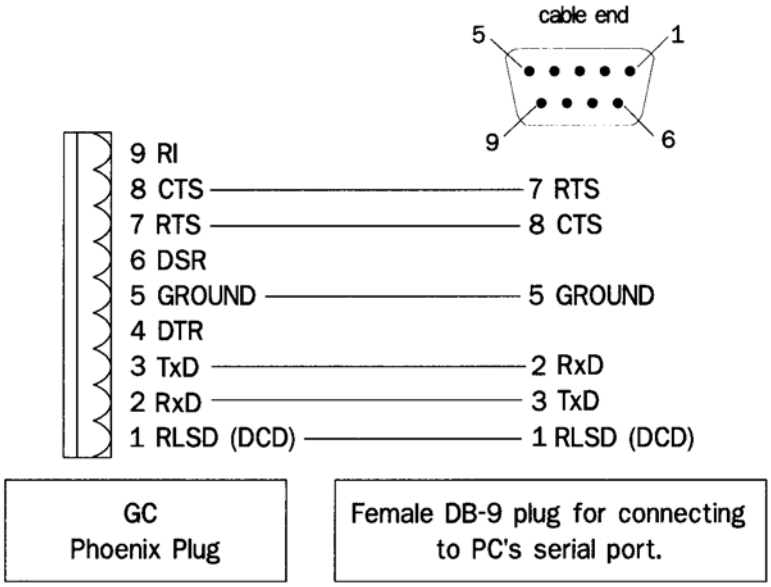


Figure A-18 GC DB 9-pin Port to PC DB 25-pin Port

A.3.5 GC PHOENIX Plug Port to PC DB 25-pin Port

To make an RS-232 serial connection between one of the Phoenix Plug serial ports of the GC, and a PC with DB 25-pin serial port, you will need to manufacture the cable and its DB 25-pin, female plug cable end as illustrated below (see Figure A-19).

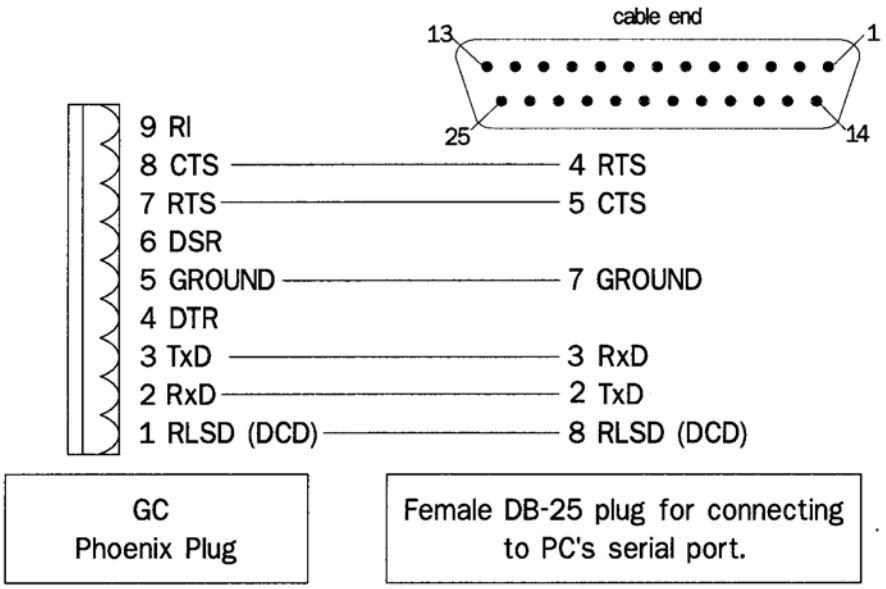


Figure A-19 GC Phoenix Plug Port to PC DB 25-pin Port

A.4 WIRING REMOTE RS-232 COMMUNICATIONS

A.4.1 GC DB 9-pin Serial Port to Modem DB 25-pin Port

To make an RS-232 serial connection between one of the DB 9-pin serial ports of the GC, and an external modem with a DB 25-pin serial port, you may use gender changes and a null modem cable purchased from any computer products supplier, or you may manufacture a cable. The manufactured null modem cable will need a male DB 9-pin connector and a male DB 25-pin connector. Wire the cable ends as illustrated below (see Figure A-20).

NOTE: The DB-9 connector on the GC serial port is wired to appear as Data Communications Equipment (DCE). Use a custom null-modem type cable to make the connection between the GC and an external modem. (GC serial ports were wired to appear as DCE so that a straight-through serial cable could be used for a direct serial connection between the GC Controller and the PC, which is Data Terminal Equipment [DTE].)

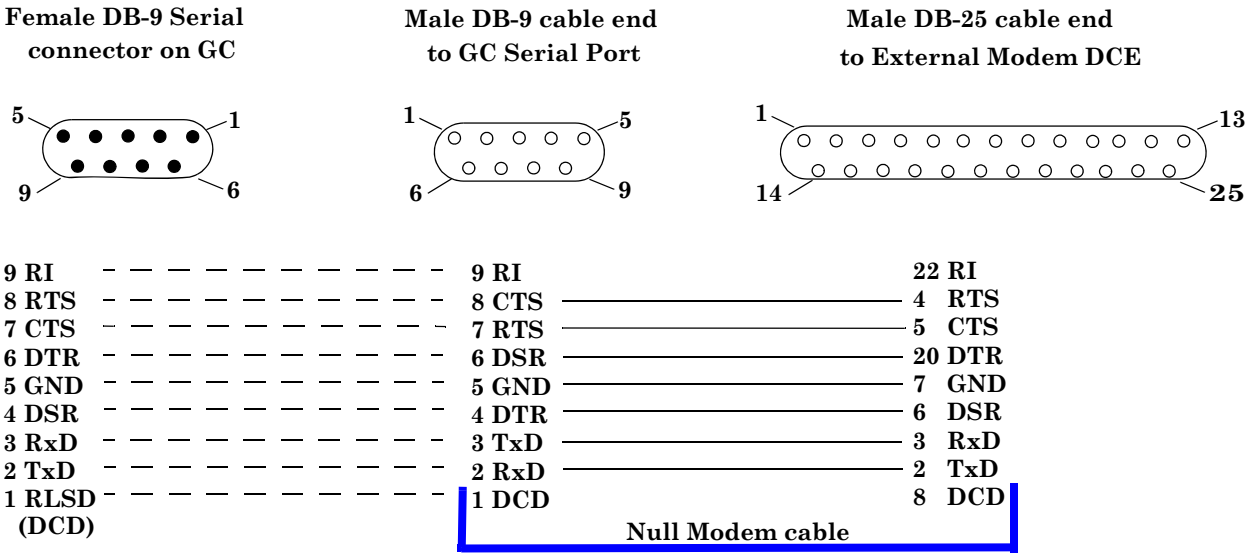


Figure A-20 GC DB 9-pin Port to External Modem DB 25-pin Port

A.4.2 GC PHOENIX Plug to Modem DB 25-pin Port

To make an RS-232 serial connection between one of the Phoenix Plug serial ports of the GC, and an external modem with DB 25-pin serial port, you will need to manufacture the cable and its DB 25-pin, male plug cable end as illustrated below (see Figure A-21).

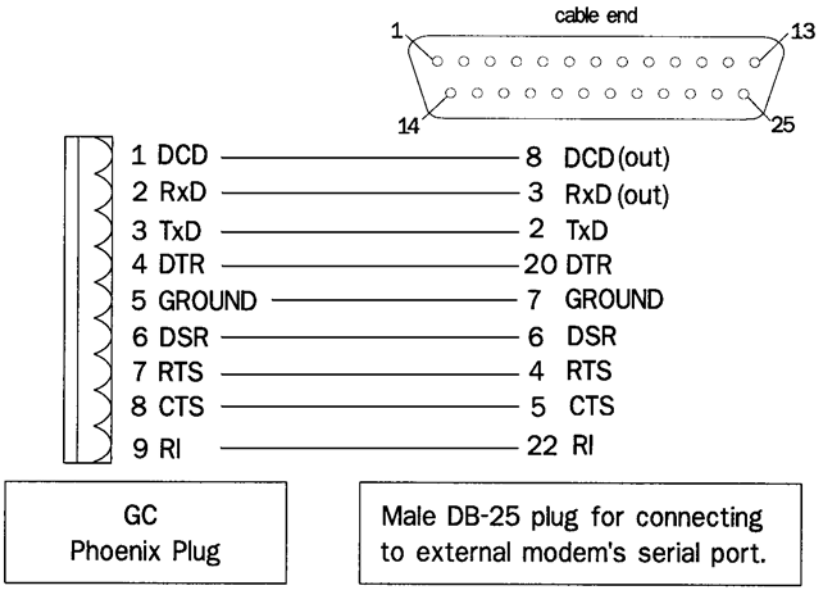


Figure A-21 GC Phoenix Plug Port to External Modem DB 25-pin Port

A.5 EXAMPLE RS-422 PC-GC CONNECTION

This section demonstrates an example RS-422 connection from a PC to GC that is accomplished through use of an asynchronous line driver/ interface device. The line driver device serves as an interface between the RS-232 output of the PC and the RS-422 protocol needed for long distance serial input to the GC. Specifics of the line driver are as follows:

NOTE: See Section 3.4 for additional details about serial communication setups.

- Black Box brand
- Model LD485A-MP RS-232/RS-485 Multipoint Line Driver
- RS-232 input (to connect to the PC)
- RS-422 or RS-485 output (to connect to the GC)

NOTE: For this example, a straight-through RS-232 serial cable is used to connect between the PC and the line driver.

RS-422 line terminations are illustrated in Figure A-22, below, and jumper and switch settings to configure the line driver device are listed in Table A-18 and Table A-19.

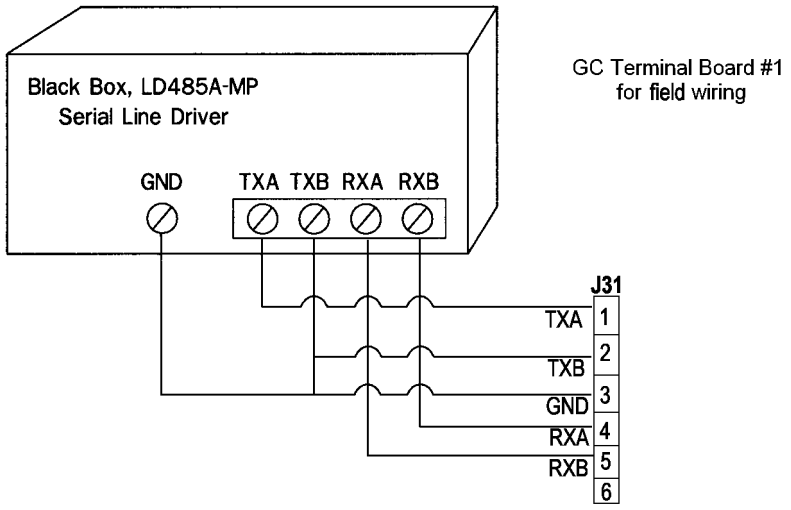


Figure A-22 Example RS-422 Serial Cable Terminations

Table A-18 Switch Settings for LD485A-MP, RS-422 to GC

Switch Type	Label	Position	Purpose
Front Panel Switch	NORMAL / DLB	NORMAL	Uses normal operation, instead of loopback testing.
DIP Switch Bank	XW1A DCE / XW1B DTE	XW1A DCE	Sets line driver to operate as data communications equipment (DCE).
DIP Switch Bank	S2	UNTERM	Eliminates need for resistor network termination to connect one PC directly to one GC.

Table A-19 Jumper Settings for LD485A-MP, RS-422 to GC

Jumper	Position	Purpose
W8	HALF	half duplex operation
W9	ON	no delay, clear to send (CTS) always true
W15	A-B	RS-485 driver enabled by request to send (RTS)
W16	A-B	half duplex turnaround delay at 5 ms
W17	B 100 ms	disable timeout delay by 100 ms
W18	B-C	RS-485 driver enabled by RTS

A.6 EXAMPLE RS-485 PC-GC CONNECTION

This section demonstrates an example RS-485 connection from a PC to GC that is accomplished through use of an asynchronous line driver/ interface device. The line driver device serves as an interface between the RS-232 output of the PC and the RS-485 protocol needed for long distance serial input to the GC. Specifics of the line driver are as follows:

NOTE: See Section 3.4 for additional details about serial communication setups.

- Black Box brand
- Model LD485A-MP RS-232/RS-485 Multipoint Line Driver
- RS-232 input (to connect to the PC)
- RS-422 or RS-485 output (to connect to the GC)

Refer to Figure A-23 and Figure A-24 for RS-485 line terminations, jumpers and switch settings to configure the line driver device (also listed in Table A-19).

NOTE: For this example, a straight-through RS-232 serial cable is used to connect between the PC and the line driver.

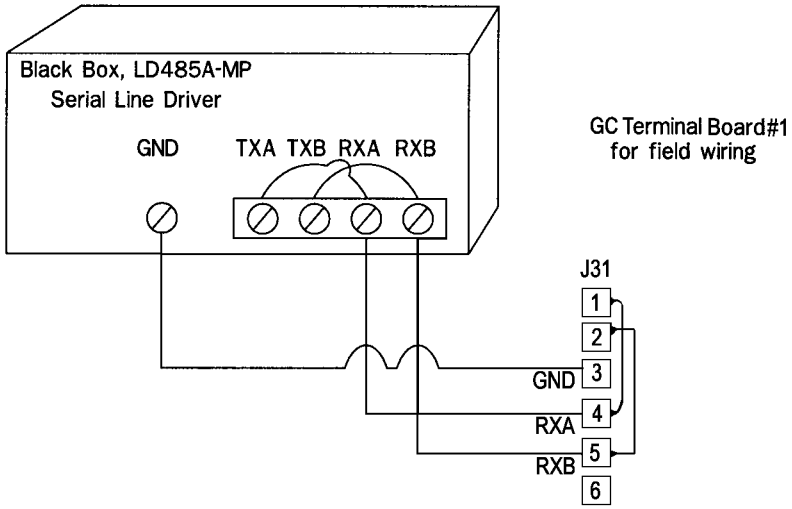


Figure A-23 Example RS-485 Serial Cable Terminations, Line Driver to GC Controller Com3

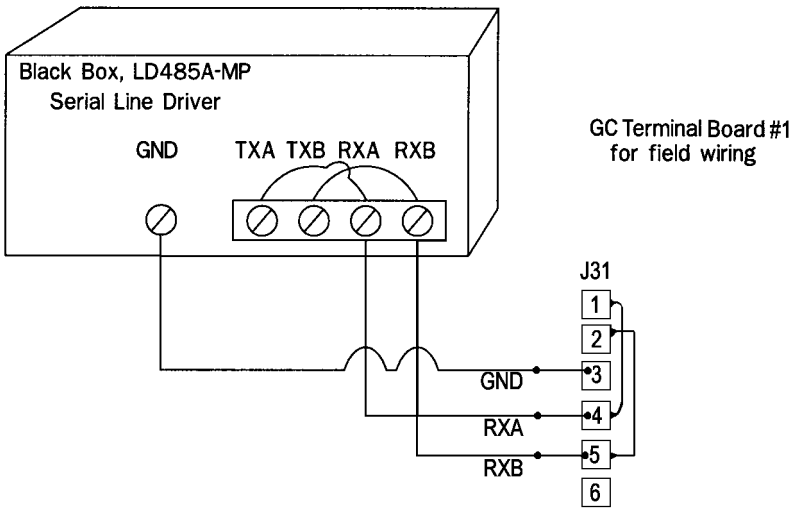


Figure A-24 Example RS-485 Serial Cable Terminations, Line Driver to GC Controller Com4, without FID

Table A-20 Switch Settings for LD485A-MP, RS-485 to GC

Switch Type	Label	Position	Purpose
Front Panel Switch	NORMAL / DLB	NORMAL	Normal operation used, instead of loopback testing.
DIP Switch Banks	XW1A DCE / XW1B DTE	XW1A DCE	Sets line driver to operate as data communications equipment (DCE).
DIP Switch Banks	S2	UNTERM	Eliminates need for resistor network termination to connect one PC directly to one GC.

Table A-21 Jumper Settings for LD485A-MP, RS-485 to GC

Jumper	Position	Purpose
W8	HALF	half duplex operation
W9	0 ms	0 milliseconds delay from time request to send (RTS) received as true until clear to send (CTS) asserted as true
W15	A-B	RS-485 driver enabled by RTS
W16	A-B	half duplex turnaround delay at 5 ms
W17	B 100 ms	disable timeout delay by 100 ms
W18	B-C	RS-485 driver enabled by RTS

APPENDIX B, MODEM INSTALLATION

This appendix provides information for installing the optional Internal Modem for the Model 1000A (P/N 3-0700-029). The modem communications is established via COM4 and MON 2000 version 2.2 software, which then redirects modem communications through to Com9.

NOTE: Revision C of the Internal Modem requires MON2000, version 2.2 or later.

B.1 OPTIONAL INTERNAL MODEM

WARNING: EQUIPMENT DAMAGE OR PERSONAL INJURY
Ensure that the power supply switch is OFF and the AC power cord is disconnected. Failure to follow this warning can result in injury or death to personnel or damage to the equipment.

To install the internal modem,

1. Halt any ongoing analysis runs.
2. Disconnect the power from the unit.
3. Open the door to the electronics enclosure to gain access to the GC components.

4. Disconnect the analog cable from J6 of the System Interface board, then disconnect all CPU cables from the System Interface board.
5. Remove the CPU assembly and install the modem, with associated hardware into J19 and J20 PC/104 Bus connector on the CPU assembly. The modem must be the top board in the assembly. See Figure below.

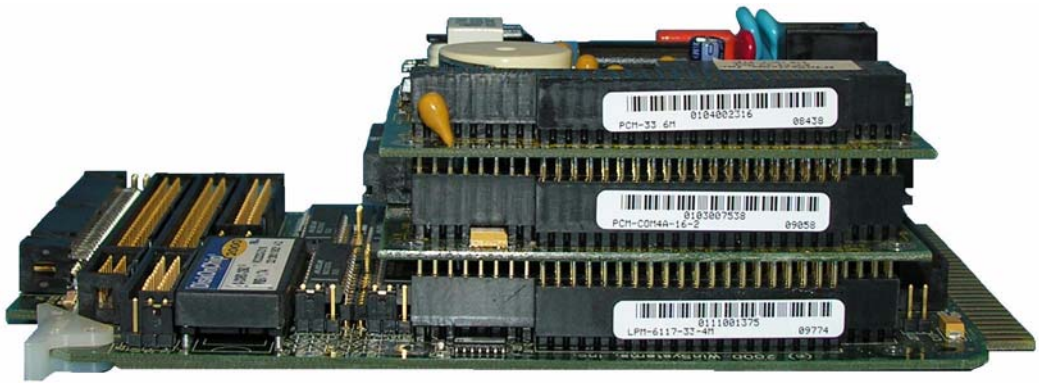


Figure B-1 Radicom 56K Baud Modem Installation

6. Set communication port jumper settings on the modem board (P/N 3-0700-029) as follows:

Jumper	Pin
J26	1-2
J27	1-2
J30	1-2
J31	2-3

7. Plug one end of the modem extension cable (P/N 3-2350-075) into RJ11 of the modem assembly. The in-line jack on the remaining end of the modem extension cable attaches to the lower left inside wall of the card cage shield (after the CPU assembly is reinstalled and all cables reconnected to the System Interface board). No software setup is required for this board.
8. Insert the phone line into the modem extension assembly.

B.1.1 Optional Ethernet Board

To add an Ethernet Assembly:

1. Disconnect the Analog cable from J6 of the FTB, then disconnect all CPU and optional board cables and lines.
2. Remove the CPU assembly and install the Ethernet assembly with associated hardware into J19 and J20 PC/104 Bus connector on the CPU assembly. If an option board is already plugged into the PC/104 Bus on the CPU, install the Ethernet assembly and mounting hardware into the PC/104 Bus connector on the option board.
3. Plug one end of the Ethernet extension cable (P/N 3-2350-088) into J5 of the Ethernet assembly. The in-line jack on the remaining end of the Ethernet extension cable attaches to the lower left inside wall of the card cage shield, after the CPU assembly is reinstalled and all cables and lines reconnected. No software setup is required for this board.
4. Run the Ethernet line through the conduit into the lower enclosure and connect it to the Ethernet extension cable.

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APPENDIX C, MANIFOLD CARRIER FOR GAS BOTTLES

C.1 CARRIER GAS

This appendix provides a description of the carrier manifold (P/N 3-5000-050) that permits connection of two carrier gas bottles, or cylinders, to a gas chromatograph (GC) system. The benefits of this manifold are as follows:

NOTE: The illustration and information in this appendix are adapted from drawing AE-10098.

- When one bottle is nearly empty (i.e., 100 psig remaining), the other bottle becomes the primary supply.
- Each bottle can be disconnected for refilling without interrupting GC operation.

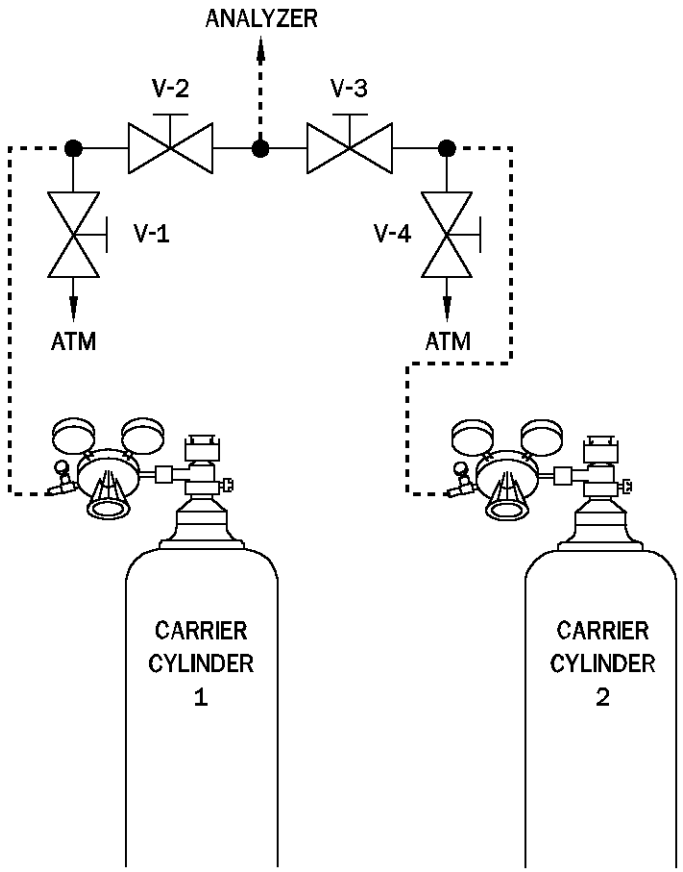

Figure C-1 Manifold for Two Carrier Gas Bottles to GC System

C.2 INSTALLATION AND LINE PURGING

To install and purge the dual-bottle carrier gas manifold, proceed as follows:

1. Install manifold as shown in Figure A-1. Close all valves and tighten all fittings. Run tubing to the Analyzer, but do not connect.
2. Back off pressure regulator (counter clockwise) fully.
3. Open cylinder valve for Carrier Cylinder 1. The pressure indicator will read the cylinder pressure.
4. Open the shut-off valve attached to the carrier regulator.
5. Regulate pressure out of the cylinder to 20 psig, then close the cylinder valve.
6. Open V-1 (bleed valve) and let the carrier gas bleed to atmosphere until both gauges read 0 psig, then close V-1.
7. Repeat Steps 4 and 5 two more times to purge the line to V-2.
8. Purge the line to V-3 by repeating Steps 2 through 6; but this time, use bleed valve V-4 and Carrier Cylinder 2.
9. With valves 1-4 closed, open both cylinder valves and regulate both carriers to approximately 10 psig.
10. Open V-2 and V-3 simultaneously, then turn both cylinder valves off and let the carrier gasses bleed through the line to the Analyzer until all gauges read 0 psig.
11. Repeat steps (8) and (9) two more times to purge line to Analyzer.
12. Close V-3, leave V-2 open.
13. Open cylinder valve of Carrier Cylinder 1 and, with carrier gas flowing at 10 psig or below, connect carrier line to Analyzer.
14. Slowly regulate Carrier Cylinder 1 to 110 psig.
15. Open V-3 and slowly regulate Carrier Cylinder 2 to 100 psig. (By doing this, all but 100 pounds of Carrier Cylinder 1 will be used before any of Carrier Cylinder 2 is used. When Carrier Cylinder 1 gets to 100 pounds, replace the cylinder). Leak-check all of the fittings carefully.
16. Let the Analyzer run overnight before calibrating.

C.3 REPLACING CARRIER CYLINDER

To replace one carrier cylinder without interrupting GC operation, proceed as follows:

1. Turn cylinder valve off.
2. Back off on cylinder pressure regulator until handle turns freely. Remove cylinder.
3. Attach new cylinder to regulator and repeat Steps 3 through 7 of Installation Instructions, Section A.2, using appropriate bleed valve to purge line. Leak-check the fitting.
4. Open the appropriate block valve to the Analyzer (V-2 or V-3) and regulate outlet pressure to appropriate level. (See Steps 14 and 15 of Installation Instructions, Section A.2.)

C.4 CALIBRATION GAS

The calibration gas used for BTU analysis should be blended of gases specified as Primary Standards. Primary Standard gases are blended using weights that are traceable to the National Institute of Standards and Technology (N.I.S.T). For other applications, the calibration gas should be blended to the specifications detailed in the analyzer's Application Data Sheets.

The calibration gas should not have any component that could drop out at the coldest temperature to which the gas will be subjected.

The sampling system should be carefully planned for the best chromatographic analyses.

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APPENDIX D, LOCAL OPERATOR INTERFACE

D.1 INTERFACE COMPONENTS FOR DISPLAYING AND ENTERING DATA

The Local Operator Interface (LOI) has multiple components that you can use to interact with the unit.

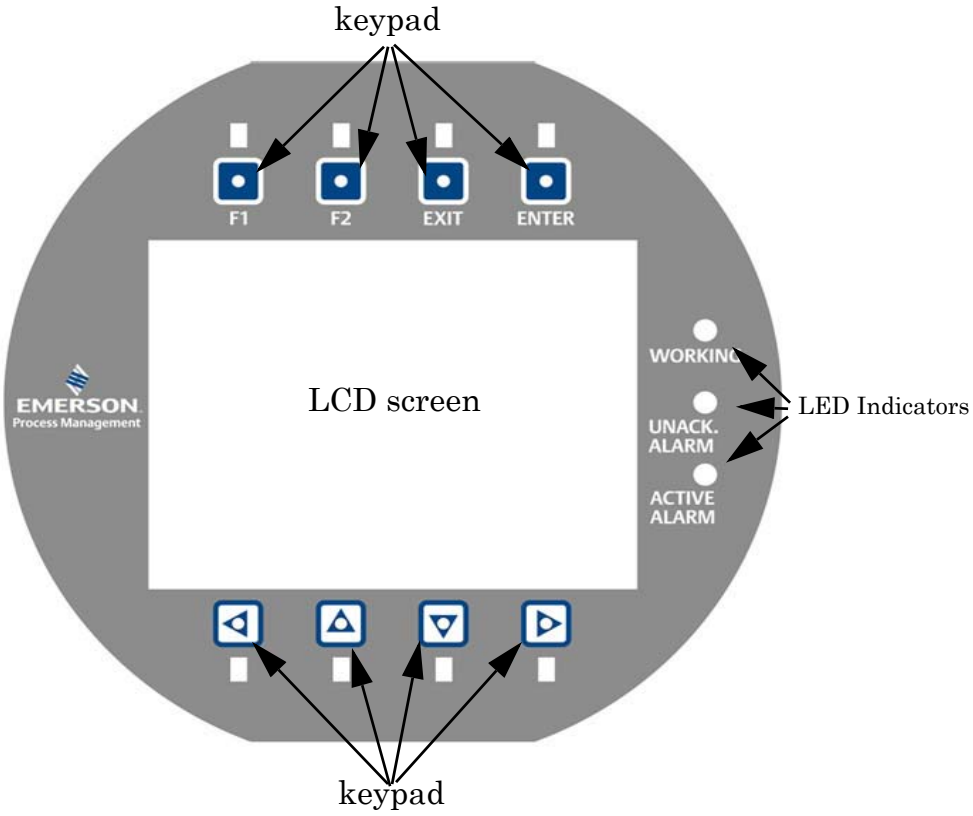


Figure D-1 LOI Unit with Interface Components Listed

D.1.1 Light Emitting Diode Indicators

There are three light emitting diode (LED) status indicators on the gas chromatograph (GC) that show the overall status of the system. These LEDs are positioned to the right of the display screen, and are labelled

WORKING, UNACK. ALARM, and ACTIVE ALARM. Each LED, when lit, indicates a specific condition.

Table D-1 GC Conditions Indicated by the LEDs

LED	Color	Condition
WORKING	Green	The GC is currently running an analysis.
UNACK. ALARM	Yellow	The GC has atleast one unacknowledged alarm.
ACTIVE ALARM	Red	The GC has an out-of-tolerance or alarm condition that requires an operator action.

D.1.2 LCD Screen

The LCD screen measures 111.4mm by 83.5 mm and is capable of 320 by 240 QVGA pixel resolution, supporting both text and full graphics. The backlighting, boost, and brightness are all under software control. The boost and brightness levels are user-adjustable.

D.1.3 Keypad

The keypad consists of eight infrared keys. Four of the keys are located above the screen, and the other four keys are located below the screen.

The keys above the LCD screen, from left to right, are labelled F1, F2, EXIT, and ENTER. The keys below the LCD screen, from left to right, are LEFT, UP, DOWN, and RIGHT.

A key is “pressed” by placing a finger on the glass over the associated key hole and then removing the finger. Holding a finger over a key hole will cause that key to auto-repeat. The function of each key is context-sensitive and therefore will be described as appropriate throughout the remainder of this appendix.

D.1.4 Security Switch

A connector is provided for an externally mounted hall-effect switch. This optional switch can be mounted in the wall of the explosion-proof enclosure and can be locked and sealed using a wire loop and lead seal so that the switch position cannot be changed without breaking the seal.

D.2 USING THE LOCAL OPERATOR INTERFACE

Upon starting the GC, the LOI automatically runs in *Status Display* mode, in which it scrolls through a predefined series of screens, displaying each screen for approximately 30 seconds.

Table D-2 Status Display Mode Screens in Order of Appearance

Status	Displays information about the operational state of the analyzer, including a scrolling list of up to 25 user-selectable parameters that can be defined or modified using the MON 2000 application.
Live Chromatogram	Displays the chromatogram for the current analysis in real time. **NOTE**: This screen does not display if the GC is not currently analyzing a sample.
Active Alarms	Lists active alarms, if any.
Temperature Control	Displays information about the PID temperature control loops.
Valves	Displays the settings and states of the stream and analyzer valves.

After 30 minutes of keypad inactivity, the LOI shifts to *Screen Saver* mode, in which the screen goes blank and the backlight turns off. Pressing any key swithces the LOI from *Screen Saver* mode to *Status Display* mode. At any time while in *Status Display* mode, the **Enter** key or the **F2** key may be pressed to invoke the *Main Menu*. Use the **Exit** key to leave the *Main Menu* and return the LOI to *Status Display* mode. If you log onto the GC from the *Main Menu* to perform operations or edit data, when you exit the menu you will automatically be logged off the LOI.

In *Status Display* mode, you can manually scroll to the next screen using the **Right** arrow key, or to the previous screen using the **Left** arrow key. You can pause automatic scrolling at any time by pressing the **Exit** key, and you can resume automatic scrolling by pressing either the **Left** or the **Right** arrow key. Automatic scrolling resumes after ten minutes of keypad inactivity.

NOTE: Mode 2 and 3 applications will display two Status screens and potentially two Chromatogram screens, one for each detector. The number of Chromatogram screens displayed depends on whether none, one, or both of the detectors are in use.

D.2.1 Navigating the Screen

LOI screens have several functions. They can display data for review; they can display data for editing; and they can be used to initiate activities.

Use the **Up** and **Down** arrow keys to navigate between fields or controls within each drop down menu. Pressing the **Down** arrow key while focus is on the last field of a drop down menu moves the focus to the first field on a screen. Alternatively, pressing the **Up** arrow key while focus is on the first field of the drop down menu causes the focus to move to the last field.

Within any given screen, the function of the **Enter** key depends upon the context. It can be used to save changes or to initiate an action.

Pressing the **Exit** key closes the currently open screen and discards any changes made to the fields or controls on the screen.

The **F1** and **F2** keys are context dependent. A one-word desrciption of the function of each of these keys displays in a green prompt box directly under the key in the title bar of the top-level full-sized screen. In some cases, **F1** acts as a toggle between scrolling either a line or a page at a time. When this is true, the currently selected option (LN or PG) displays with a green background and black text, while the non-selected option displays with a black background and green text. The **F2** key, when **MAIN** is displayed in its prompt box, closes all screens that were opened through the *Main Menu* and goes back to the *Main Menu*. If edits were made, the operator will be prompted to save or cancel the changes, or to abort the original close request.

When a key is pressed, the word “LED” appears in green in the upper left corner of the top-level full-sized screen to acknowledge that the key closure was recognized.

D.2.2 Editing Numeric Data

Use the **Left** and **Right** arrow keys to move through the individual characters within the field and to select the character to be changed. Use the **Up** and **Down** arrows keys to select the value of each digit. The possible values are 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, - (minus), . (period), E, and ' ' (space).

The - (minus) value is available for signed numbers.

The . (period) and E values are available for floating-point numbers, except for Retention Times and Timed Event values.

The ' ' (space) value is available for Retention Times and Timed Event values, and for the most significant digit in the "tens" position or greater.

The **Down** arrow key moves backward in the list from the current value of the selected digit.

The **Up** arrow key moves forward in the list from the current value of the selected digit.

The **F1 (BACKSP)** key acts as a backspace, except when editing Retention Times and Timed Event values. It deletes the digit immediately to the left of the current position.

The **Enter** key validates and saves the entry.

The **Exit** key cancels any changes and restores the previous value.

D.2.3 Editing Non-Numeric Data

The function of the keys when editing non-numeric data is context-dependant.

D.2.3.1 PIN fields

PIN fields take numbers (0 - 9) and letters (A - Z).

D.2.3.2 Check Boxes

Press **F1 (SELECT)** to select or clear a check box.

D.2.3.3 Buttons

Press **F1 (EXECUTE)** to 'click' the button and execute the function.

D.2.3.4 Radio Buttons

1. Press **F1 (SELECT)** to select within a group of radio buttons.

2. Use the **Up** and **Down** arrow keys to move through the various radio buttons within the group.
3. Press **Enter** to accept the current selection. Press **Exit** to abort any change and to restore the previous selection.

D.2.3.5List Boxes

1. Press **F1 (SELECT)** to switch the list box to edit, or selection, mode.
2. Use the **Up** and **Down** arrows keys to move between the values within the list box.
3. Press **Enter** to accept the current selection. Press **Exit** to abort the new selection and the list box will revert to the previous selection.

D.2.3.6Combo Boxes

1. Press **F1 (SELECT)** to expand the drop-down list of available values.
2. Use the **Up** and **Down** arrow keys to move between the values.
3. Press **Enter** to select the current value. Press **Exit** to restore the combo box's initial value.

D.2.3.7Spreadsheets (test)

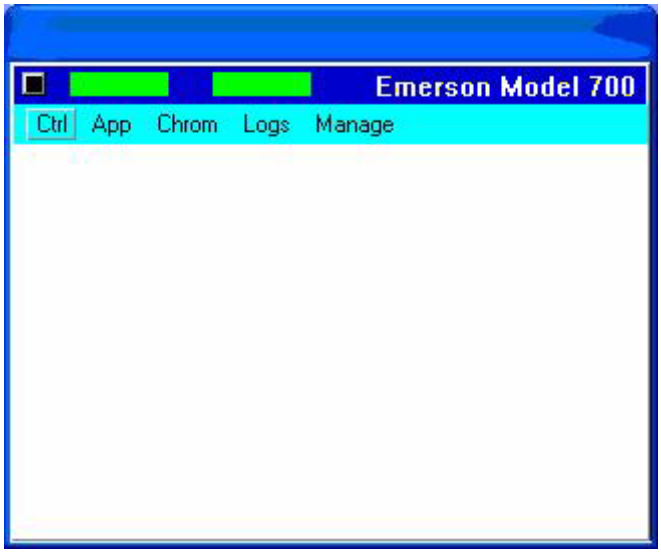
1. Press **F1 (MOVE)** to switch the control to navigation mode.
2. Use the arrow keys to navigate the individual cells.
3. If the cell is editable, press **F1 (EDIT)** to switch the currently-selected cell to edit mode.
4. Edit the cell according to its type (numeric field, combo box, etc.).
5. To discard the changes to the edited cell and return it to its original value, press **Exit**. The 'Save Changes?' dialog appears. Go to Step 9.
6. To accept the change to the edited cell, press **Enter**.
7. Repeat Steps 1 through 7 for any other cells that you want to edit.
8. To save all changes, press Enter. The 'Save Changes?' dialog appears.
9. To save changes, press **F1 (Execute)**. To discard changes, select the **No** button and press **F1 (Execute)**.

D.2.3.8Tables

A table looks and behaves similarly to a spreadsheet, except a table supports multiple lines of text in each cell, as necessary, and table cells are not editable.

When navigating within a table, press **F1** to toggle between scrolling the screen in Line Mode (LN) or Page Mode (PG). Line Mode scrolls the text in the cell one line at a time, while Page Mode scrolls the text one page at a time.

D.3 NAVIGATING THE LOI MENUS



NOTE: The top blue "bar" and border that surround the example images of the menus and screens do not exist on the actual LOI. They are the result of screen captures from a Windows-based emulation of the LOI.

The *Main Menu* has five top-level submenus: *Crtl*, *App*, *Chrom*, *Logs*, and *Manage*.

Use the four arrow keys to navigate between the submenus.

Press **Enter** to access the selected submenu.

Press **Esc** to collapse an open submenu.

If no submenus are open, pressing **Esc** closes the *Main Menu* and logs off the user.

Table D-3 List of Submenus and Commands

MAIN MENU	
Submenu	Command
Crtl	
	Auto Sequence
	Single Stream
	Halt
	Calibration
	Stop Now
App	
	System
	Status
	Component Data
	Time Event Table
	Valves
	Temperature Control
Chrom	
	View

Table D-3 List of Submenus and Commands

Logs	
	Maintenance Log
	Event Log
	Alarm Log
	Unacked Logs
	Active Alarms
	Reports → Display
	Reports → Print
Manage	
	Log Off
	LOI Settings

Refer to the *MON2000 Software for Gas Chromatographs User Manual*, P/N 3-9000-522, for detailed information regarding the commands that are available through the submenus.

D.3.1 The Ctrl Menu

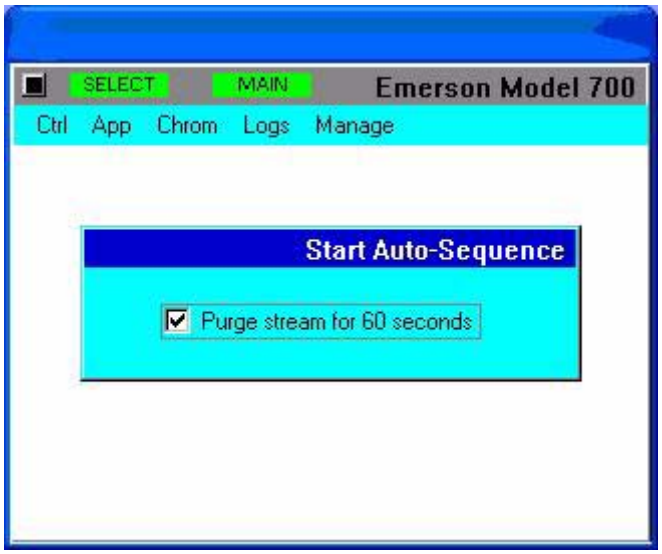
The *Ctrl* menu enables you to stop, calibrate, or place on automatic control a sample stream from the analyzer. You must log on to the GC to use these functions.

D.3.1.1 Auto Sequence

Use this command to start continuous GC analysis runs that follow a predefined stream sequence. At initial startup, the current stream in the sequence is the first stream analyzed.

1. If you are not logged in, do so.

2. Select *Auto Sequence* from the *Ctrl* submenu. The Start Auto-Sequence screen appears.



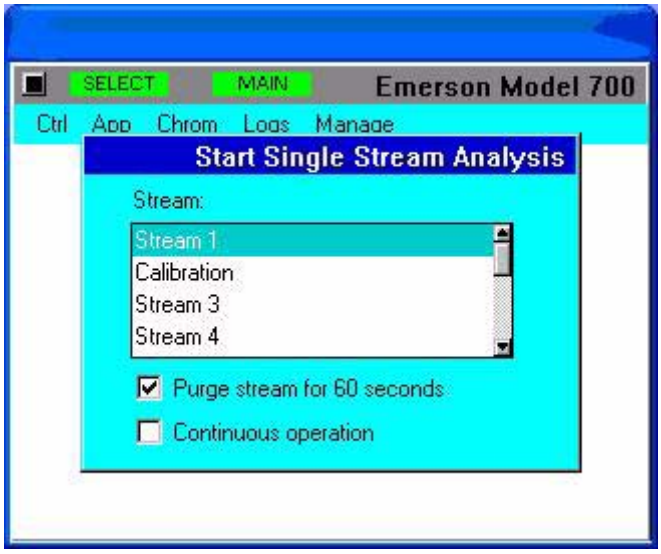
3. If you want to send sample gas through the sample loop for 60 seconds prior to beginning the first analysis, use the **F1** key to check the *Purge stream for 60 seconds* checkbox. The check box is checked by default. If you do not want to purge the sample loop, clear the *Purge stream for 60 seconds* checkbox.
4. Press **Enter** to start auto sequencing, or press **Exit** to abort. The *Main Menu* reappears.

D.3.1.2Single Stream

Use this function to start GC analysis run(s) on a single stream. At initial startup, the current stream in the sequence is the first stream analyzed.

1. If you are not logged in, do so.

2. Select *Single Stream* from the *Ctrl* submenu. The *Start Single Stream Analysis* screen appears.

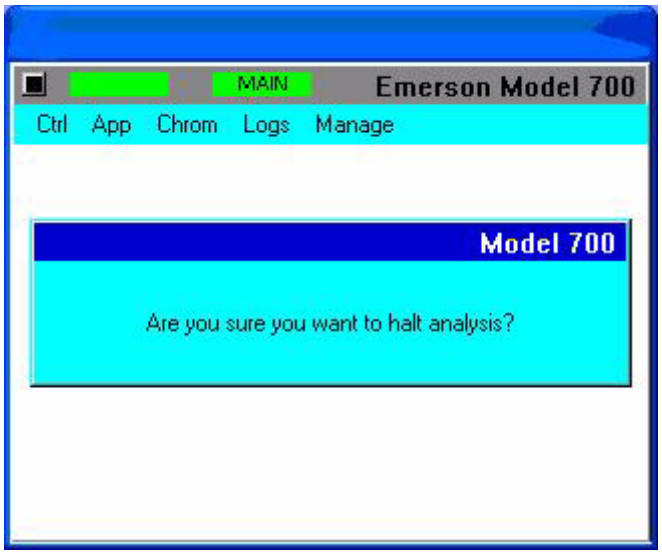


3. Press **F1 (Select)** and use the arrow keys to select the desired stream from the Stream: list box.
4. Press **Enter** to accept your selection, or **Exit** to abort.
5. Use the **Down** arrow key to move to the *Purge stream for 60 seconds* check box. If you want to send sample gas through the sample loop for 60 seconds prior to beginning the first analysis, use the **F1** key to check the *Purge stream for 60 seconds* checkbox. The check box is checked by default. If you do not want to purge the sample loop, clear the *Purge stream for 60 seconds* checkbox.
6. Use the **Down** arrow key to move to the *Continuous operation* check box. If you want to perform repetitive analysis runs, use the **F1** key to check the *Purge stream for 60 seconds* checkbox. The check box is cleared by default, which means only a single analysis will be run.
7. Press **Enter** to start the single stream analysis run(s), or press **Exit** to abort. The *Main Menu* reappears.

D.3.1.3Halt

Use this screen to stop the current operation mode at the end of a run that is in progress.

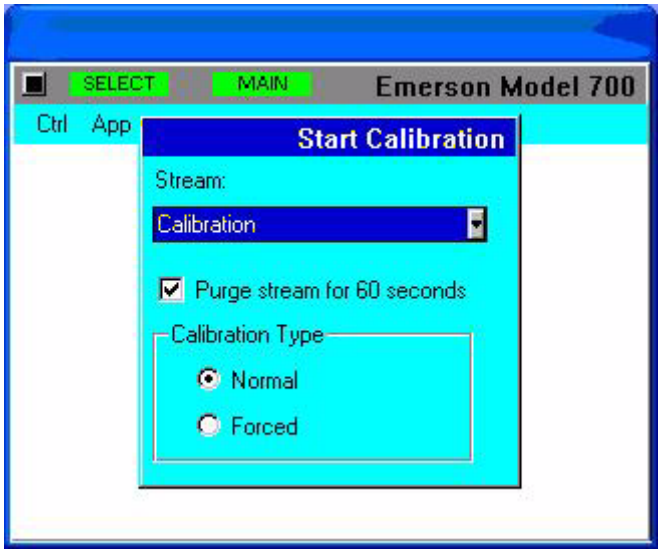
1. If you are not logged in, do so.
2. Select *Halt* from the *Ctrl* submenu. The *Halt* screen appears.



3. Press **Enter** to halt the analysis after the current run finishes, or press **Exit** to abort. The *Main Menu* reappears.

D.3.1.4Calibrating the GC

1. If you are not logged in, do so.
2. Select *Calibration* from the *Ctrl* submenu. The *Start Calibration* screen appears.



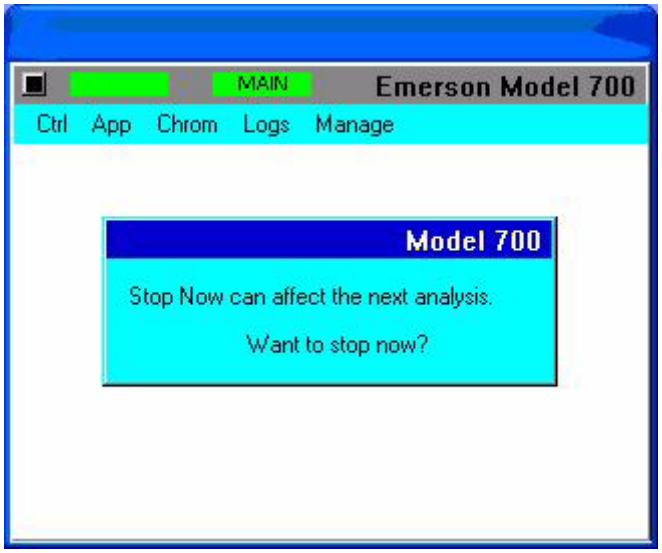
3. Press **F1 (Select)** to open the *Stream:* combo box's drop-down list.
4. Use the **Up** and **Down** arrow keys to move through the drop-down list and to highlight the stream that you want to calibrate. Only streams designated as calibration streams under the *Streams* submenu display in the drop-down list.
5. Press **Enter** to accept your selection, or **Exit** to abort.
6. Use the **Down** arrow key to move to the *Purge stream for 60 seconds* check box. If you want to send sample gas through the sample loop for 60 seconds prior to beginning the first analysis, use the **F1** key to check the *Purge stream for 60 seconds* checkbox. The check box is checked by default. If you do not want to purge the sample loop, clear the *Purge stream for 60 seconds* checkbox.
7. Use the **Down** arrow key to move to the Calibration Type section. Use **F1 (Select)** to enable navigation between the *Normal* and *Forced* check boxes. Use the **Up** or **Down** arrow key to select your choice. If you want the CDT for the selected stream(s) to be updated with the new Response Factors only if all Response Factors are within acceptable deviations, select *Normal*. If you want the CDT for the selected stream(s) to be updated with raw data regardless of acceptable deviations, select *Forced*.
8. Press **Enter** to accept your selection, or press **Exit** to abort.

9. Press **Enter** to start the calibration, or press **Exit** to abort. The *Main Menu* reappears.

D.3.1.5Stop Now

Use this screen to immediately stop all analysis and calibration runs.

1. If you are not logged in, do so.
2. Select *Stop Now* from the *Ctrl* submenu. The *Stop Now* screen appears.



3. Press **Enter** to immediately halt the current GC activity, or press **Exit** to abort. The GC goes into idle mode and the *Main Menu* reappears.

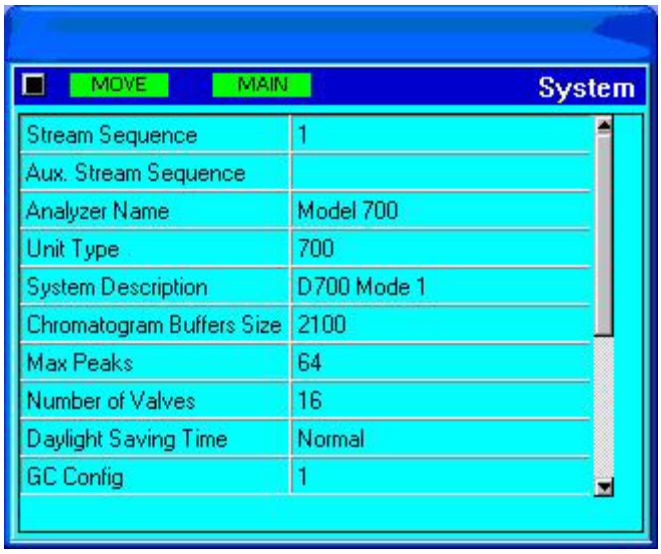
D.3.2 The App Menu

The *App* menu commands allow you to view, and in some cases edit, application-specific parameters, such as retention times, calibration concentrations, Timed Event values, and valve settings.

D.3.2.1System

Use this read-only screen to view various system parameters such as the Stream sequence, Unit name, and System description.

1. Select *System* from the *App* submenu. The *System* screen appears.

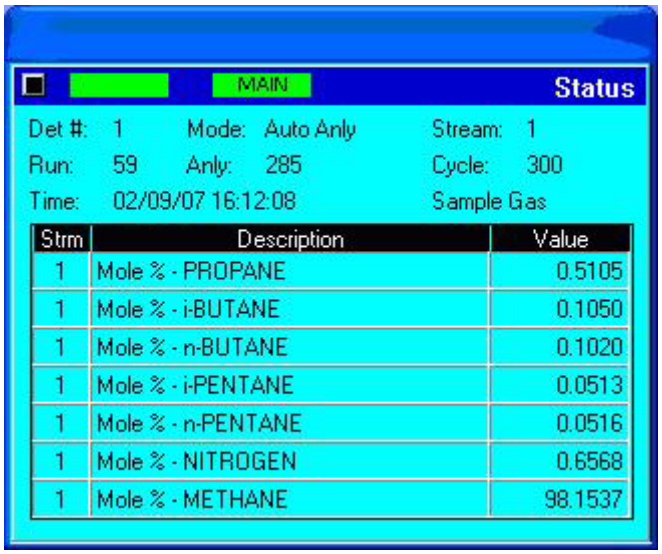


2. To scroll thru the list, press the **F1 (Move)** key.
3. Use the **Up** and **Down** arrow keys to scroll through the list .
4. Press **Enter** or **Exit** to switch from scrolling mode.
5. Press **Exit** to leave this screen and return to the *Main Menu*.

D.3.2.2Status

Use this screen to view various parameters about the current operational state of the controller, such as the Mode, Current Stream, Run time, Analysis time, and Cycle time. You can also view an automatically scrolling list of user-specifiable parameters that can be configured using MON2000.

1. Select *Status* from the *App* submenu. The *Status* screen appears.

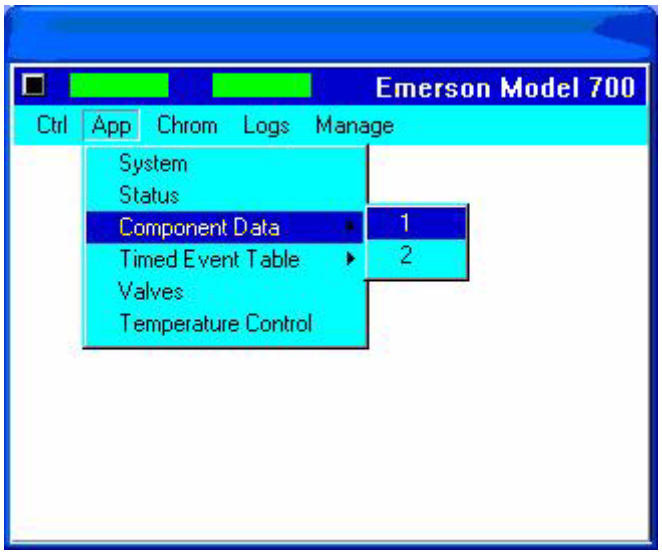


2. Press **`Exit`** to leave this screen and return to the *Main Menu*.

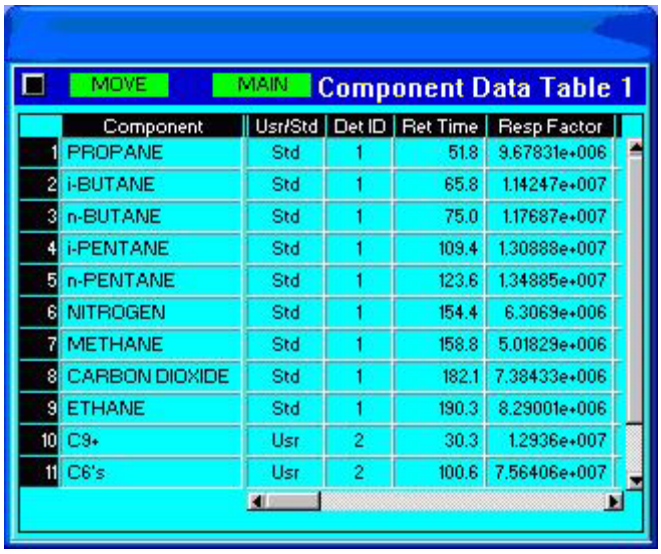
D.3.2.3Component Data

Use this menu item to view and edit a Component Data Table.

1. Select *Component Data* from the *App* submenu.



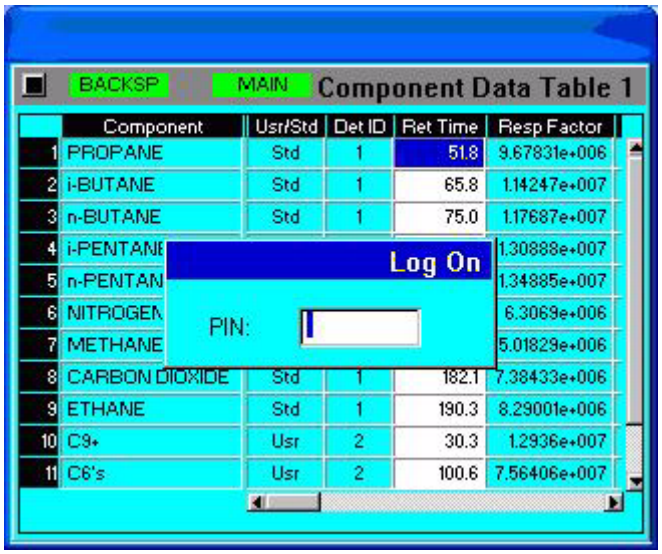
2. Select the number for the Component Data table that you want to view or edit from the *Component Data* submenu. The *Component Data Table* screen appears.



	Component	Usr/Std	Det ID	Ret Time	Resp Factor
1	PROPANE	Std	1	51.8	9.67831e+006
2	i-BUTANE	Std	1	65.8	1.14247e+007
3	n-BUTANE	Std	1	75.0	1.17687e+007
4	i-PENTANE	Std	1	109.4	1.30888e+007
5	n-PENTANE	Std	1	123.6	1.34885e+007
6	NITROGEN	Std	1	154.4	6.3069e+006
7	METHANE	Std	1	158.8	5.01829e+006
8	CARBON DIOXIDE	Std	1	182.1	7.38433e+006
9	ETHANE	Std	1	190.3	8.29001e+006
10	C9+	Usr	2	30.3	1.2936e+007
11	C6's	Usr	2	100.6	7.56406e+007

3. To navigate the list of components, press **F1(Move)**.
4. Use the **Up**, **Down**, **Left**, and **Right** arrow keys to scroll horizontally or vertically through the list.

   Editable fields display in white while non-editable fields display in cyan. Only the fields in the Retention Time and Calibration Concentration columns are editable, and you must be logged in to edit these fields.
5. To edit a value, navigate to that cell and press **F1 (Edit)**. If you are not logged in, the *Log On* screen appears, allowing you to log in. Enter your PIN and press **Enter**.

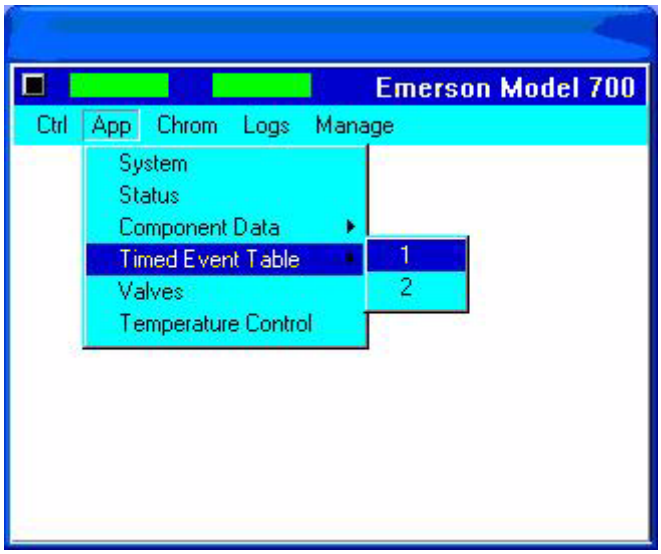


6. After editing the selected field, press **Enter** to accept your changes or press **Exit** to cancel the operation. If you want to edit another cell, navigate to it and repeat the process by pressing **F1 (Edit)**. You can edit and accept or cancel as many fields as you require.
7. Press **Enter** or **Exit** to switch from scrolling mode.
8. Press **Enter**. The *Save changes?* prompt appears.
9. Press **Enter** to save your changes or press the **Down** arrow key once and then press **Enter** to discard them.
10. Press **Exit** to leave the *Component Data* screen and return to the *Main Menu*.

D.3.2.4Timed Event Table

Use this screen to view and edit Timed Event Tables.

1. Select *Timed Event Table* from the *App* submenu.



2. Select the number for the Timed Event Table that you want to view or edit from the *Timed Event Table* submenu. The *Timed Events* screen appears.

SFL01		Off	0.0
Inhibit	On	Det 1	0.0
Inhibit	On	Det 2	0.0
Valve #	2 - Dual Column	On	1.0
Slope Sens	10	Det 2	2.0
Peak Width	4	Det 1	3.0
Slope Sens	8	Det 1	4.0
Peak Width	4	Det 2	4.0
Valve #	3 - S/BF 2	On	5.0
Valve #	1 - S/BF 1	On	5.0

3. To navigate the list of events, press **F1(Move)**.

4. Use the **Up**, **Down**, **Left**, and **Right** arrow keys to scroll horizontally or vertically through the list.

   Editable fields display in white while non-editable fields display in cyan. Only the fields in the Time column are editable, and you must be logged in to edit these fields.

5. To edit a value, navigate to that cell and press **F1 (Edit)**. If you are not logged in, the *Log On* screen appears, allowing you to log in. Enter your PIN and press **Enter**.

6. Use the **Up** and **Down** arrows to change the cell's value.
7. After editing the selected field, press **Enter** to accept your changes or press **Exit** to cancel the operation. If you want to edit another cell, navigate to it and repeat the process. You can edit and accept or cancel as many fields as you require.
8. Press **Enter** or **Exit** to switch from scrolling mode.
9. Press **Enter**. The *Save changes?* prompt appears.
10. Press **Enter** to save your changes or press the **Down** arrow key once and then press **Enter** to discard them.

11. Press **Exit** to leave the *Timed Events* screen and return to the *Main Menu*.

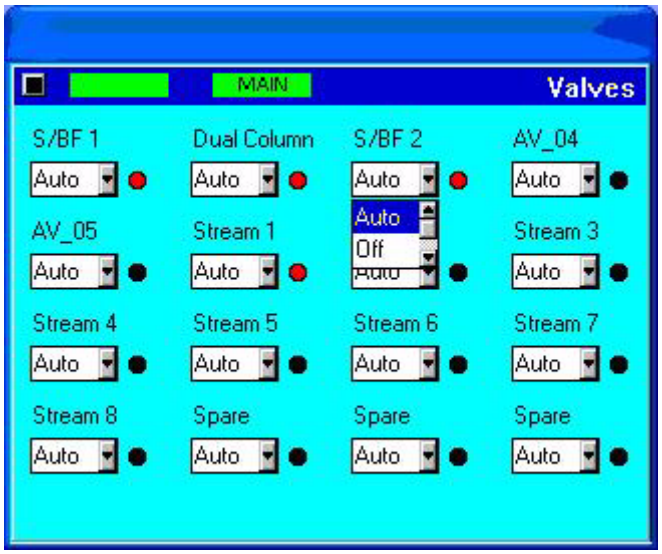
D.3.2.5Valves

Use this screen to monitor valve operation and to control valve operational modes.

1. Select *Valves* from the *App* submenu. The *Valves* screen appears.

   The round indicators to the right of each combo box reveal the current state of a valve. A red indicator means the valve is on and a black indicator means the valve is off.

2. To change a valve's operational mode, use the **Up** or **Down** arrow keys to move to the desired valve.
3. Press **F1 (Select)**. The combo box opens and a drop-down list box appears.



4. Use the **Up** or **Down** arrow keys to select the desired operational mode.

Table D-4 Operational Modes for Valves

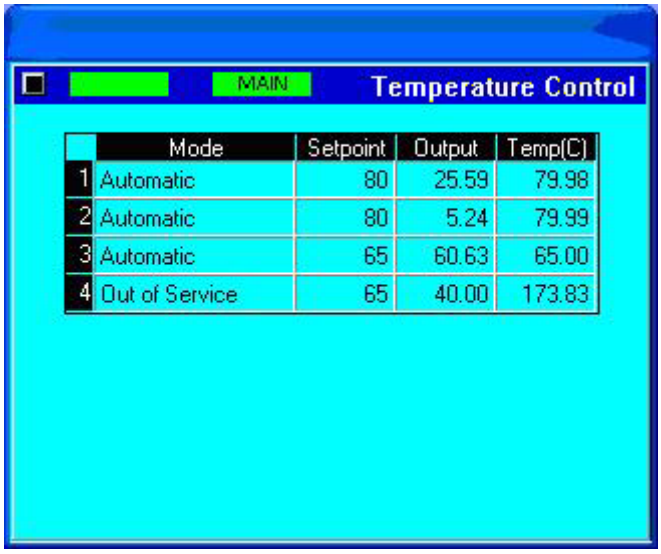
Auto	Valve operation is controlled by the GC application.
Off	Valve is closed.
On	Valve is open.
Test	Valve fires alternately on and off, once per second for 20 cycles and when done, goes into Auto mode.

5. Press **Enter** to accept your selection or **Exit** to cancel it.
6. Press **Exit** to leave the *Valves* screen and return to the *Main Menu*.

D.3.2.1Temperature Control

Use this menu option to monitor the temperatures of the oven and the Stream Switching Block to determine when the GC is thermally stable.

1. Select *Temperature Control* from the *App* submenu. The *Temperature Control* screen appears.



2. Press **Exit** to leave the *Temperature Control* screen and return to the *Main Menu*.

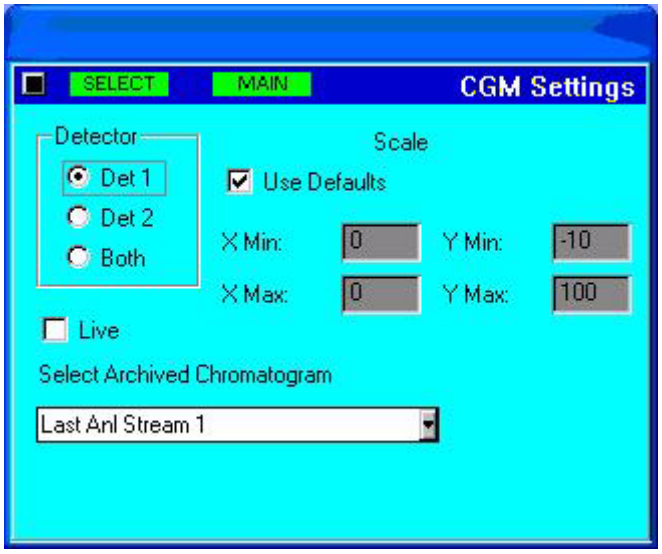
D.3.3 The Chrom Menu

Use this menu item to display a chromatogram, live or archived. The GC saves the most recent chromatogram from each stream in the stream sequence as well as the chromatogram for the most recent calibration run for each CDT.

1. Select *View* from the *Chrom* submenu. The *CGM Settings* screen appears.

   You can view live or archived chromatograms for up to two detectors. If the GC has one detector, the *Det 2* and *Both* check boxes will be grayed out. If the GC is Idle, the *Live* check box will be grayed out, and you can only view archived chromatograms. If no analyses or calibrations have been run, the *Selected Archive Chromatogram* combo box will be available on the *CGM Settings* screen. If you select a

live chromatogram, the *X Min* field will be grayed out and set to 0.

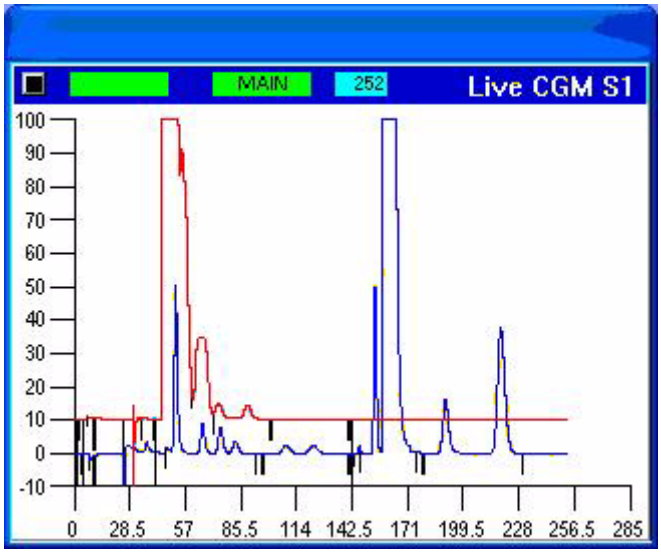


2. To select the check box from the *Detector* section for the detector(s) whose chromatogram(s) you want to view, press **F1 (Select)**.
3. Use the **Up** or **Down** arrow key to move to the desired option.
4. Press **Enter** to accept your selection or **Exit** to cancel.
5. Use the **Down** arrow key to move to the *Use Defaults* check box. If you do not want to modify the scaling, skip to Step 7, otherwise, press **F1 (Select)** to clear the *Use Defaults* check box and continue to Step 5.

Table D-5 Scaling Values Defintions

X Min	Can only be edited when viewing Archive CGMs. This option is grayed out when a live CGM is selected. The default is zero.
Y Min	The default value is -10.
X Max	The default value is the same as the cycle time. The minimum value when editing the scaling must be greater than X Min + 10.
Y Max	The default value is 100. The minimum value when editing the scaling must be greater than Y Min + 10.

6. To change a scaling value, use the **Up** or **Down** arrow keys to move to the desired axis and press **F1 (Edit)**.
7. Use the **Left** and **Right** arrow keys to select the field.
8. Press **F1 (Backspace)** to delete the digit immediately to the left of the cursor.
9. Use the **Up** and **Down** arrow keys to edit the scale values.
10. Press **Enter** to accept the change. The CGM Setting screen exits Edit Mode.
11. Repeat the editing steps until all scales are changed as desired.
12. After changing the values, press **Enter** to accept the new values or press **Exit** to cancel them.
13. Use the **Down** arrow key to move to the *Live* check box.
14. To view a live chromatogram, press **F1 (Select)** and **Enter**. The *Live CGM* screen appears.



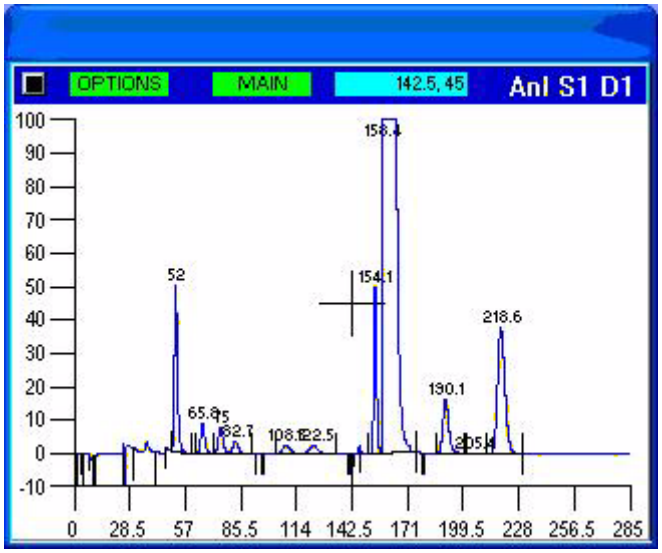
The screen displays a chromatogram in real time for the detector(s) that you selected from the *CGM Settings* window. In addition to the detector data, tick marks appear along the plot to indicate timed events as they occur. When first invoked, the plot may take a few seconds to process and display the current results of the ongoing

analysis, after which, new data is drawn as it becomes available. The run time for the current analysis displays (in seconds?) in the cyan box located in the title bar at the top of the screen.

If the *X max* scaling value was modified to a value less than the analysis time, the chromatogram scrolls by one X-axis tick mark interval each time the end of the screen is reached. When the current analysis is complete, the plot clears, and the next analysis displays as its data becomes available.

Press **Exit** at any time to close this screen and return to the *CGM Settings* screen.

15. To view an archived chromatogram, clear the *Live* checkbox, if necessary, by pressing **F1 (Select)**.
16. Use the **Down** arrow key to move to the *Select Archived Chromatogram* combo box.
17. Press **F1 (Select)** to open the combo box's drop-down list of available chromatograms.
18. Use the **Up** or **Down** arrow keys to select the desired stream to view and press **Enter** to accept your selection. The archived chromatogram screen appears.



The archived chromatogram screen displays an archived chromatogram for the stream that you selected from the *Select Archived Chromatogram* combo box. By default, the screen shows the retention time for a peak directly above it. Integration baselines and integration start and stop tick marks also display on the screen, in addition to the timed event tick marks.

A cursor displays as a black '+' in the middle of the plot. Use the arrow keys to move the cursor in the desired direction. The new coordinates update after each movement in the cyan box in the title bar at the top of the screen. If the plot has been zoomed in, the cursor will move as far as possible in the desired direction until it has no more room to move. At this point, assuming that there is more of the chromatogram available in that direction, the plot scrolls by one axis tick interval.

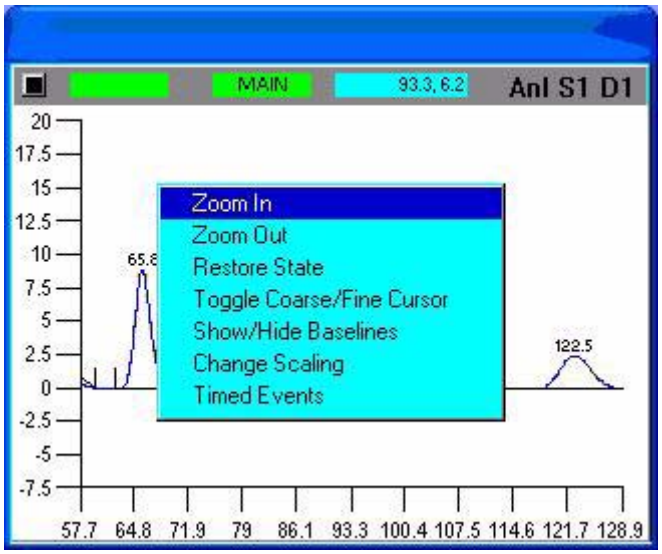
For information on manipulating the archived chromatogram screen, see Section D.3.3.1.

19. Press **Exit** to leave the *CGM Settings* screen and return to the *Main Menu*.

D.3.3.1 Working with the Archived Chromatogram Screen

You have several options in viewing the data displayed on the archived chromatogram screen.

1. While viewing the archived chromatogram screen, press **F1 (Options)**. The options menu appears.



2. Select the desired function and press **Enter**, or press **Exit** to close the menu and return to the archived chromatogram screen.

Table D-6 Definition of Archived Chromatogram Screen Options

Zoom in	Zooms in using the cursor position as a reference point, cutting the visible portion of the plot in half.
Zoom out	Zooms .out using the cursor position as a reference point, doubling the visible portion of the plot.
Restore State	Restores the plot to the default scaling coordinates (X-axis: 0 to analysis time, Y-axis: -10 to 100).
Toggle Coarse/Fine Cursor	By default, the coarse cursor, which is larger and less accurate, is visible. Selecting this option will toggle between the coarse cursor and the finecursor, which is smaller and more accurate.
Show/Hide Baselines	Selecting this option toggles between displaying the plot with or with out the peak retention times, integration baselines, and integration start and stop tick marks.
Change Scaling	Displays the *CGM Scaling* screen. Use the **Up** or **Down** arrow key to navigate to the value(s) you want to modify. To edit a value, press **F1 (Edit)**. After modifing the values, press **Enter** to accept them, or **Exit** to cancel them. Press **Enter** to redraw the plot using the new scale.

Table D-6 Definition of Archived Chromatogram Screen Options

Timed Events	Displays the *Timed Event Table* screen for the Timed Event Table associated with the chromatogram.

D.3.4 The Logs Menu

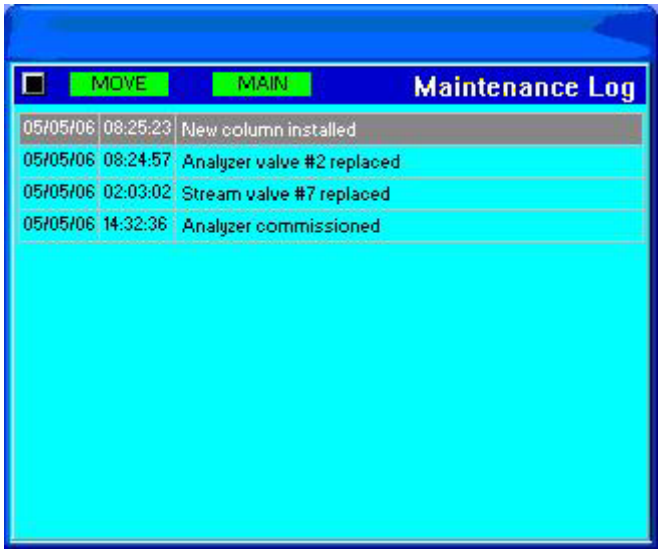
The *Logs* menu gives you the following options:

- View historic maintenance information.
- View historic operator actions and changes.
- View historic alarm conditions and alarm history.
- View or send reports to the GC's printer.

D.3.4.1 Maintenance Log

Use this menu item to view a read-only log of maintenance activities on a GC.

1. Select *Maintenance Log* from the *Logs* submenu. The *Maintenance Log* screen appears.



2. If a vertical scroll bar is present, press **F1 (Move)** to switch to scrolling mode, and use the **Up** and **Down** arrow keys to scroll through

the log. There are two scrolling modes, a line-by-line (LN) or page-by-page (PG). The default mode is page-by-page. To toggle between modes, press **F1 (LN/PG)**. The currently selected mode displays in green with black text in the **F1** prompt box, while the non-selected mode displays in black with green text. Press **Enter** or **Exit** to exit scrolling mode.

3. Press **Exit** to close the *Maintenance Log* screen and to return to the *Main Menu*.

D.3.4.2Event Log

Use this menu item to view a read-only log of the system and operator events that have occurred on a GC. This screen refreshes once a minute.

1. Select *Event Log* from the *Logs* submenu. The *Event Log* screen appears.

MOVE
MAIN
Event Log
daniel 07/01/06 08:35:36 anlin[4].label, Old: <4 > New: < >
daniel 07/01/06 08:35:36 anlin[3].label, Old: <3 > New: < >
daniel 07/01/06 08:35:36 anlin[2].label, Old: <2 > New: < >
daniel 07/01/06 08:35:36 anlin[1].label, Old: <1 > New: < >
daniel 07/01/06 08:35:26 anlin[4].label, Old: < > New: <4 >
daniel 07/01/06 08:35:26 anlin[3].label, Old: < > New: <3 >
daniel 07/01/06 08:35:26 anlin[2].label, Old: < > New: <2 >
daniel 07/01/06 08:35:26 anlin[1].label, Old: < > New: <1 >
daniel 07/01/06 08:33:12 ADC700 Electrometer Gain Set to Low
daniel 07/01/06 08:32:15 ADC700 Flame Mode Set to Auto
daniel 06/30/06 15:23:52 odt[1][1].rt, Old: 9678310 New: 9678317
daniel 06/29/06 13:09:12 ADC700 Flame Lit
daniel 06/29/06 13:08:32 ADC700 H2 Valve Opened

2. If a vertical scroll bar is present, press **F1 (Move)** to switch to scrolling mode, and use the **Up** and **Down** arrow keys to scroll through the log. There are two scrolling modes, a line-by-line (LN) or page-by-page (PG). The default mode is page-by-page. To toggle between modes, press **F1 (LN/PG)**. The currently selected mode displays in green with black text in the **F1** prompt box, while the non-selected

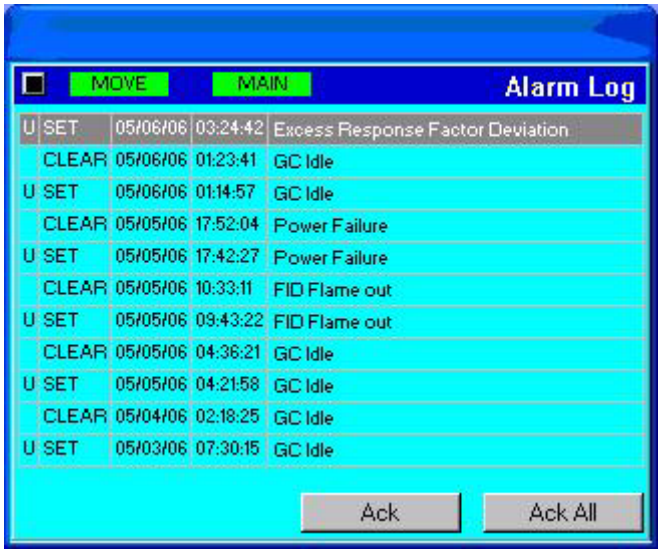
mode displays in black with green text. Press **Enter** or **Exit** to exit scrolling mode.

3. Press **Exit** to close the *Event Log* screen and to return to the *Main Menu*.

D.3.4.3Alarms Log

Use this menu item to read or acknowledge the various entries in the Alarm Log. The log always displays the 50 most recent events and refreshes once a minute.

1. Select *Alarm Log* from the *Logs* submenu. The *Alarm Log* screen appears.


MOVE
MAIN
Alarm Log
U SET 05/06/06 03:24:42 Excess Response Factor Deviation
CLEAR 05/06/06 01:23:41 GC Idle
U SET 05/06/06 01:14:57 GC Idle
CLEAR 05/05/06 17:52:04 Power Failure
U SET 05/05/06 17:42:27 Power Failure
CLEAR 05/05/06 10:33:11 FID Flame out
U SET 05/05/06 09:43:22 FID Flame out
CLEAR 05/05/06 04:36:21 GC Idle
U SET 05/05/06 04:21:58 GC Idle
CLEAR 05/04/06 02:18:25 GC Idle
U SET 05/03/06 07:30:15 GC Idle
Ack
Ack All

2. If a vertical scroll bar is present, press **F1 (Move)** to switch to scrolling mode, and use the **Up** and **Down** arrow keys to scroll through the log. There are two scrolling modes, a line-by-line (LN) or page-by-page (PG). The default mode is page-by-page. To toggle between modes, press **F1 (LN/PG)**. The currently selected mode displays in green with black text in the **F1** prompt box, while the non-selected mode displays in black with green text. Press **Enter** or **Exit** to exit scrolling mode.

3. To acknowledge a single alarm, do the following:

(a) Scroll through the log until the desired alarm is highlighted and press **Enter** to exit scrolling mode.

(b) Press the **Down** or **Up** arrow key until the **Ack** button is highlighted.

(c) Press **F1 (Execute)** to acknowledge the selected alarm. The screen refreshes and clears the unacknowledged alarm from the *Unacked Alarm* screen.

4. To accept all unacknowledged alarms, do the following:

   (a) Press the **Up** or **Down** arrow key until the **Ack All** button is highlighted.

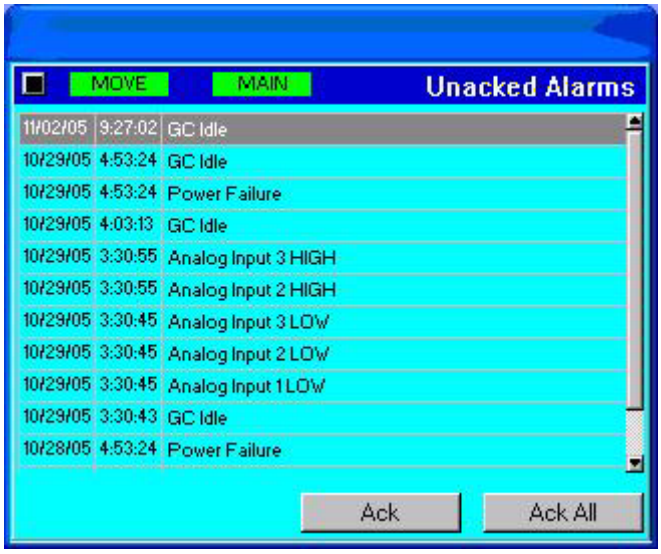
   (b) Press **F1 (Execute)**. The system acknowledges all of the unacknowledged alarms and the screen refreshes and clears all the unacknowledged alarms from the *Unacked Alarm* screen. The screen displays the 'No Unacknowledged Alarms' message.

5. Press **Exit** to close the *Alarm Log* screen and to return to the *Main Menu*.

D.3.4.4 Unacked Alarms Log

Use this menu item to read or accept the unacknowledged alarms in the system. The screen refreshes once a minute.

1. Select *Unacked Alarms* from the *Logs* submenu. The *Unacked Alarms* screen appears.



2. If a vertical scroll bar is present, press **F1 (Move)** to switch to scrolling mode, and use the **Up** and **Down** arrow keys to scroll through the log. There are two scrolling modes, a line-by-line (LN) or page-by-page (PG). The default mode is page-by-page. To toggle between modes, press **F1 (LN/PG)**. The currently selected mode displays in green with black text in the **F1** prompt box, while the non-selected mode displays in black with green text. Press **Enter** or **Exit** to exit scrolling mode.

3. To acknowledge a single alarm, do the following:

   (a) Scroll through the log until the desired alarm is highlighted and press **Enter** to exit scrolling mode.

   (b) Press the **Down** or **Up** arrow key until the **Ack** button is highlighted.

   (c) Press **F1 (Execute)** to acknowledge the selected alarm. The screen refreshes and clears the 'U' status indicator from the acknowledged alarm.

4. To accept all unacknowledged alarms, do the following:

   (a) Press the **Up** or **Down** arrow key until the **Ack All** button is highlighted.

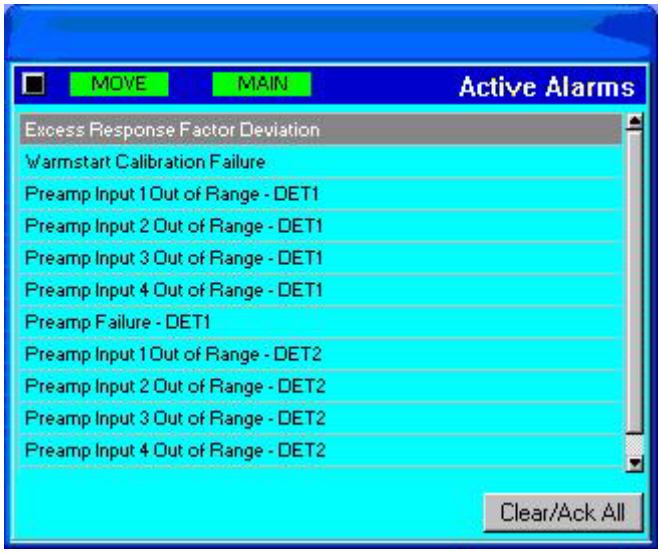
(b) Press **F1 (Execute)**. All unacknowledged alarms will be acknowledged and the screen refreshes and clears the 'U' status indicators from the acknowledged alarms.

5. Press **Exit** to close the *Unacked Alarms* screen and to return to the *Main Menu*.

D.3.4.5Active Alarms

Use this screen to read, acknowledge, or clear the active alarms in the system. This screen refreshes once a minute.

1. Select *Active Alarms* from the *Logs* submenu. The *Active Alarms* screen appears.


MOVE
MAIN
Active Alarms
Excess Response Factor Deviation
Warmstart Calibration Failure
Preamp Input 1 Out of Range - DET1
Preamp Input 2 Out of Range - DET1
Preamp Input 3 Out of Range - DET1
Preamp Input 4 Out of Range - DET1
Preamp Failure - DET1
Preamp Input 1 Out of Range - DET2
Preamp Input 2 Out of Range - DET2
Preamp Input 3 Out of Range - DET2
Preamp Input 4 Out of Range - DET2
Clear/Ack All

2. If a vertical scroll bar is present, press **F1 (Move)** to switch to scrolling mode, and use the **Up** and **Down** arrow keys to scroll through the log. There are two scrolling modes, a line-by-line (LN) or page-by-page (PG). The default mode is page-by-page. To toggle between modes, press **F1 (LN/PG)**. The currently selected mode displays in green with black text in the **F1** prompt box, while the non-selected mode displays in black with green text. Press **Enter** or **Exit** to exit scrolling mode.

3. To acknowledge and clear active alarms, do the following:

(a) Press the **Up** or **Down** arrow key until the **Clear/Ack All** button is highlighted.

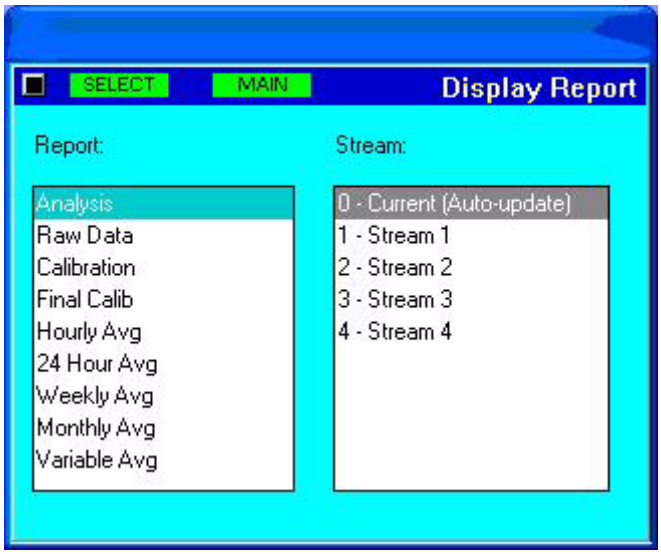
(b) Press **F1 (Execute)**. All alarms will be acknowledged and cleared, and the screen refreshes and displays the following message: **No active alarms**.

4. Press **Exit** to close the *Active Alarms* screen and to return to the *Main Menu*.

D.3.4.6Display Report

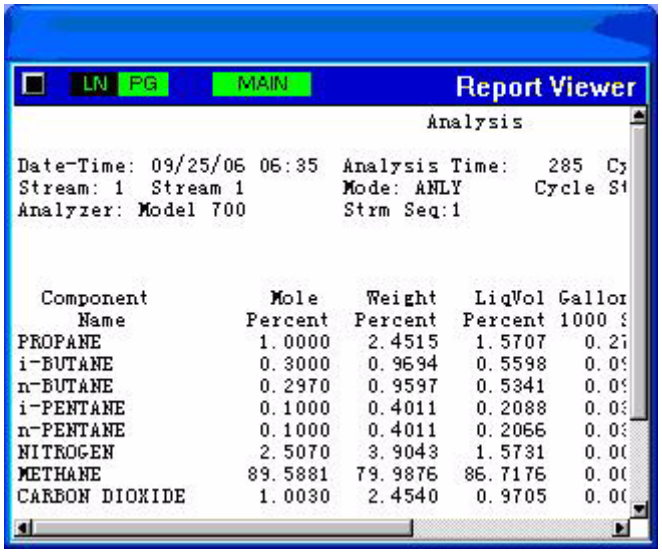
Use this screen to select the report you want to display.

1. Select *Display Report* from the *Logs* submenu. The *Display Report* screen appears. The default selections are Analysis (in Report Column) and Current (in Stream Column). If an analysis is running, hit **Enter** to display a report for the last analysis on the current stream.



2. Press **F1 (Select)** to allow navigation in the *Report* list box.
3. Press either the **Up** or **Down** arrow key until the desired report is highlighted.
4. Press **Enter** to accept your selection.
5. Press either the **Up** or **Down** arrow key to go to the *Stream* list box.

6. Press **F1 (Select)** to allow navigation within the list box.
7. Press either the **Up** or **Down** arrow key until the desired stream is highlighted.
8. Press **Enter** to accept your selection.
9. To display the selected report on the *Report Viewer* screen, press **Enter**, or press **Exit** to cancel and return to the *Main Menu*.

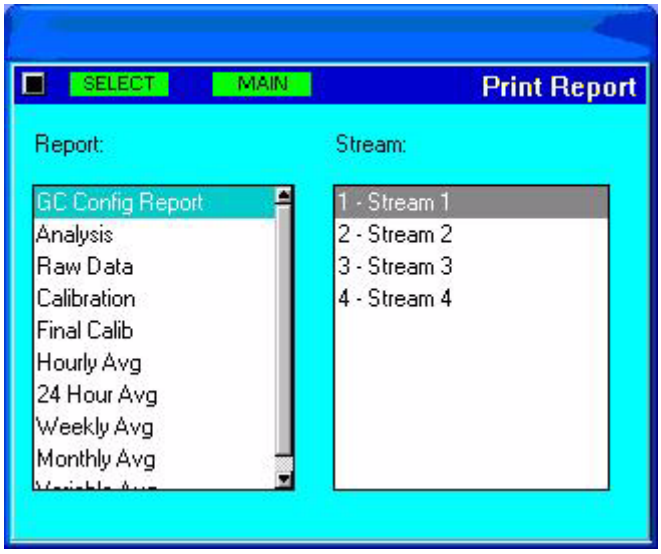


The *Report Viewer* screen has two scrolling modes, a line-by-line (LN) or page-by-page (PG). The default mode is page-by-page. To toggle between modes, press **F1 (LN/PG)**. The currently selected mode displays in green with black text in the **F1** prompt box, while the non-selected mode displays in black with green text. Press **Exit** to close the *Report Viewer* screen and return to the *Main Menu*.

D.3.4.7Print Report

Use this menu item to select the report you want to print on the GC's local printer.

1. Select *Print Report* from the *Logs* submenu. The *Print Report* screen appears.



2. Press **F1 (Select)** to allow navigation in the *Report* list box.
3. Press either the **Up** or **Down** arrow key until the desired report is highlighted.
4. Press **Enter** to accept your selection.
5. Press either the **Up** or **Down** arrow key to go to the *Stream* list box.
6. Press **F1 (Select)** to allow navigation within the list box.
7. Press either the **Up** or **Down** arrow key until the desired stream is highlighted.
8. Press **Enter** to accept your selection.
9. To print the report, press **Enter**, or press **Exit** to cancel and return to the *Main Menu*.

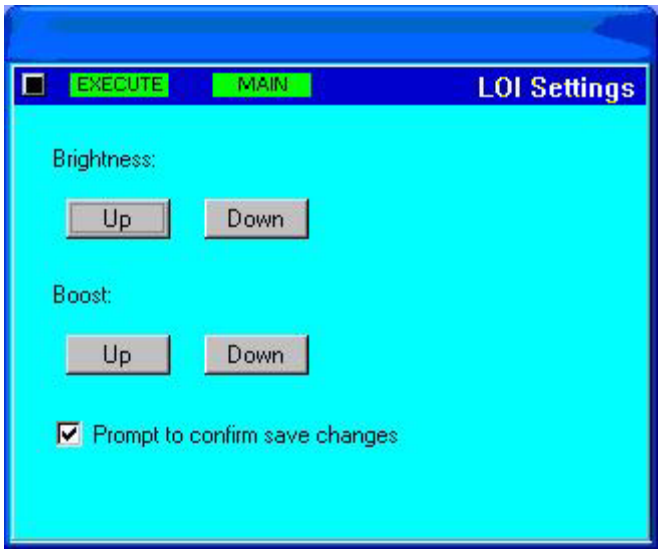
D.3.5 The Manage Menu

The *Manage* menu commands allows you to log off from the GC and to adjust the LCD screen's boost and brightness levels.

D.3.5.1LOI Settings

Use this menu item to control the appearance of the LCD screen and to turn on or off the default prompting to confirm saving changes.

1. Select *LOI Settings* from the *Manage* submenu. The *LOI Settings* screen appears.



2. To increase or decrease either Brightness or Boost, navigate to the desired **Up** or **Down** button using the **Up** or **Down** arrow key.
3. Press **F1 (Execute)** as many times as necessary to achieve the level of brightness or boost that you desire. The new level(s) will become the default setting for the LCD screen.
4. To disable or enable the *Confirm on Save* prompt that appears whenever you accept changes, do the following:
   (a) Navigate to the *Prompt to confirm save changes* check box and press **F1 (Select)**.
   (b) Press **Enter** to save your selection or **Exit** to cancel and return to the *Main Menu*.

APPENDIX E, ENGINEERING DRAWINGS

E.1 LIST OF ENGINEERING DRAWINGS

This addendum contains the following engineering drawings for the Model 1000A Gas Chromatograph.

BE-21154 Assembly Modem Board Model 1000A GC

CE-20765 Assembly CPU 2350A/700 (Sheets 1 and 2)

CE-21276 Assembly Micro-FID Model 1000A GC

DE-20991 Internal Cable Wiring Model 1000A Analyzer (Sheets 1 & 2)

DE-20992 Field Wiring Field Termination Board Model 1000A GC

DE-21405 Internal Wiring Micro-FID

DE-21446 Internal Cable Wiring, Argon/Nitrogen Carrier (TCD) (Sheets 1 & 2)

DE-21613 Assembly, Model 1000A (Sheets 1 & 2)

DE-21613 Assemblies, Control Card, Front Panel w/ Solenoid Switches, Field Termination PCB, Model 1700 (Sheets 3 & 4)

DE-20992 Field Wiring, Model 700 GC

CE-20234 Assembly, Valve, 6-Port, Chromatograph (TGP)

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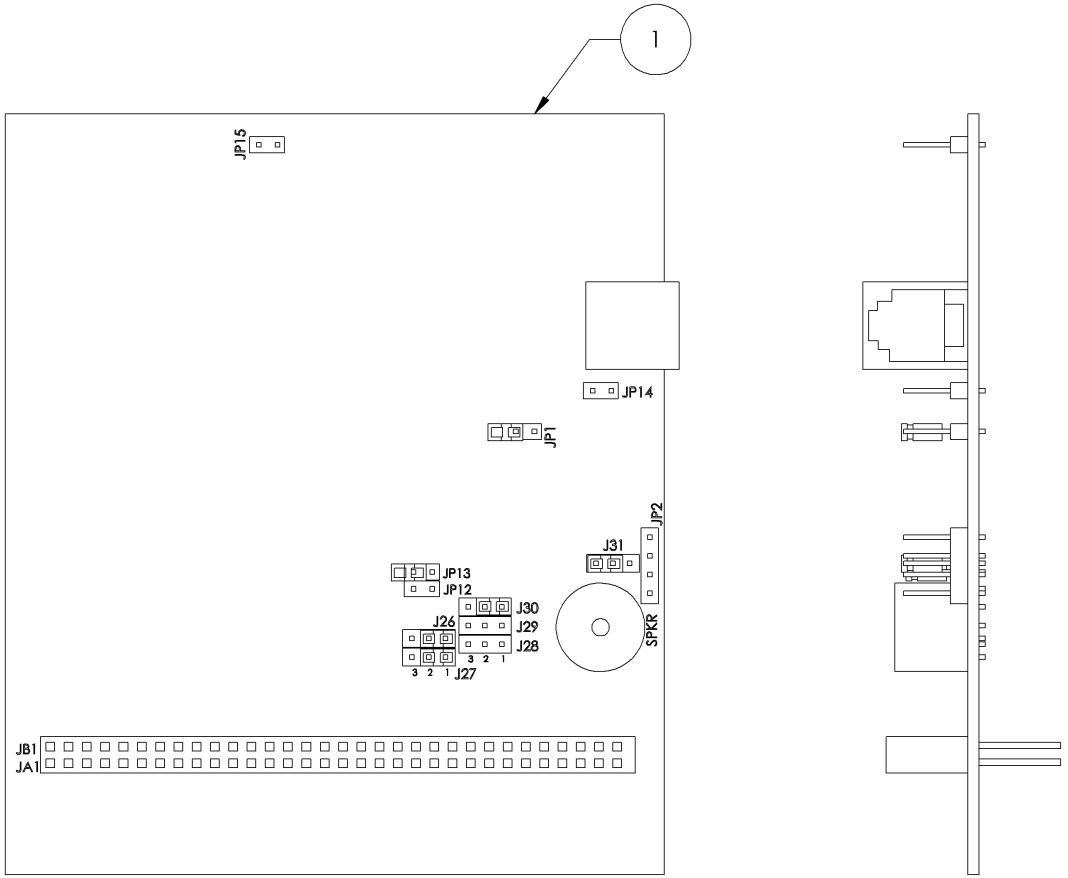


NOTES:

1. INSTALL 2 POSITION JUMPERS
   J26(1-2), J27(1-2), J30(1-2), J31(2-3)
2. MASK SOCKETS CONTACTS (COMPONENT SIDE) AND PINS (SOLDER SIDE) ON PC104 CONNECTORS JA1 AND JB1 TOP COVER OPENING OF SPEAKER. (ALL JUMPER STRIPS)
   JP14, JP15, JP1, JP2, J31, JP12, JP13, J26,-J30.
   COAT PER MEP 47429.
3. PLACE BRADY LABELS ON BACK OF BOARD FOR TRACEABILITY.
4. PLACE 2 EACH OF STANDOFF SCREWS, AND NUT (ITEM 2, 3, & 4) IN BAG (ITEM 5) AND PUT WITH EACH BOARD.

SI METRIC

THIRD ANGLE PROJECTION

MATERIAL
SEE ORDER

FINISH
SEE ORDER

PROJ. FILE NO. G-00001

REV	DATE	DRN	DESCRIPTION	CHKD	APPD
B	6-29-04	DLT	REL'D XX-209763	EM	DLT
A	1-29-04	HM	REL'D XX-196577	DLT	AC
2	10-21-03	HM	ADDED NOTE #4	DLT	AC
1	9-24-03	HM	RELEASED		

FILENAME:BE21154B1.SLDDRW, DATE: 6-29-04, TIME: 9:39 A.M.

THIS DRAWING IN DESIGN AND DETAIL IS OUR PROPERTY AND MUST NOT BE USED EXCEPT IN CONNECTION WITH OUR WORK. IT SHALL NOT BE REPRODUCED AND SHALL BE RETURNED TO US ON DEMAND. ALL RIGHTS ARE RESERVED.

GEOMETRIC TOLERANCES & DIMENSIONS PER
ANSI Y14.5
LATEST REVISION

UNLESS OTHERWISE NOTED
ALL DIMENSIONS IN INCHES

X.XX	±.015
X.XXX	±.005
ANGULAR	±0° 30'
FINISH	200 RA MAX

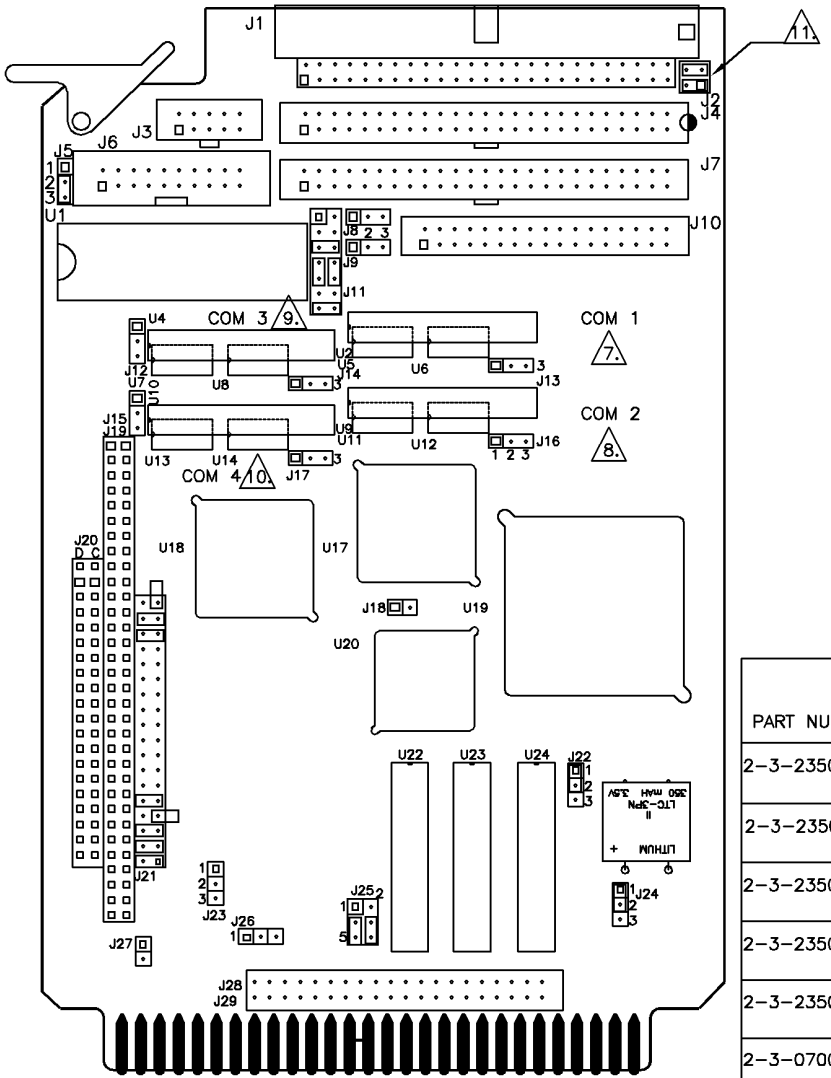
BREAK ALL SHARP CORNERS TO .003-.015 RADIUS AND REMOVE ALL BURRS

EMERSON. Process Management

TITLE

ASSEMBLY
MODEM BOARD
MODEL 700 GC

DRN	HM	DATE	8/11/03	DWG NO.	BE-21154		REV B
CHKD	DLT	DATE	1-29-04				
APPD	AC	DATE	1-29-04	SCALE	NTS	P/N 3-0700-029	SHT 1OF1



ASSEMBLY NOTES:

1. MASK OFF GOLD FINGERS AT LOCATION J29, CONNECTORS J1, J3, J4, J6, J7, J10, J19, J20, AND J28, JUMPERS STRIPS J2, J5, J8, J9, J11–J18, AND J21–J27, AND IC'S AND SOCKETS AT LOCATIONS U1, U2, AND U4–U14. CONFORMAL COAT PER MEP 47429.
2. AT LOCATION J11, INSTALL THE FOLLOWING JUMPERS PINS 5–6, 7–9, 8–10 AND 13–14.
3. AT LOCATION J21, INSTALL THE FOLLOWING JUMPERS 1–2, 3–4, 5–6, 9–10, 31–32, AND 33–34. HANG JUMPERS FROM ONE PIN ON PINS 7 AND 35 FOR OPTIONS IN TABLE.
4. CONFIRM JUMPERS J5 PIN 2–3, J22 PIN 1–2, J24 PIN 1–2, AND J25 PINS 3–5 AND 4–6. INSTALL JUMPERS J8, J9 AND J12 THROUGH J17 PER TABLE. REMOVE INSTALL IC'S PER TABLE.
5. INSTALL DISK ON CHIP INTO SOCKET AT LOCATION U1, NOTING ORIENTATION OF PIN 1.
6. ADD BRADY LABELS TO BACK OF BOARD.

7. U2, U5, U6, J8, AND J13 ARE ASSOCIATED WITH COM 1.

8. U9, U11, U12, J9, AND J16 ARE ASSOCIATED WITH COM 2.

9. U4, U7, U8, J12, AND J14 ARE ASSOCIATED WITH COM 3.

10. U10, U13, U14, J15, AND J17 ARE ASSOCIATED WITH COM 4.

11. FOR ALL DASH NUMBERS EXCEPT –028, CONNECT J2 PINS 1–3 AND 2–4. FOR –028, CONNECT PINS 1–2 AND 3–4.

PART NUMBER	OUTPUT MODE	COM1	COM2	COM3	COM4	JUMPER TABLE	IC'S INSTALLED	IC'S REMOVED/ NOT INSTALLED
2-3-2350-090	A	RS232C	RS232C	RS232C	RS232C	J8, J9, J12, J15(PINS 1 & 2) J13, J14, J16, J17(NONE)	U2, U4, U9, U10	U5, U6, U7, U8, U11, U12, U13, U14
2-3-2350-091	B	RS232C	RS232C	RS485	RS485	J8, J9, J12, J15(PINS 1 & 2) J14, J17(PINS 2 & 3); J13, J16(NONE)	U2, U8, U9, U14	U4, U5, U6, U7, U10, U11, U12, U13
2-3-2350-092	C	RS232C	RS232C	RS485	RS232C	J8, J9, J12, J15(PINS 1 & 2) J14(PINS 2 & 3); J13, J16, J17(NONE)	U2, U8, U9, U10	U4, U5, U6, U7, U11, U12, U13, U14
2-3-2350-093	D	RS232C	RS232C	RS422	RS232C	J8, J9, J12, J15(PINS 1 & 2) J13, J14, J16, J17(NONE)	U2, U7, U8, U9, U10	U4, U5, U6, U11, U12, U13, U14
2-3-2350-094	E	RS232C	RS485	RS422	RS232C	J8, J9, J12, J15(PINS 1& 2) J16(PINS 2 & 3); J13, J14, J17(NONE)	U2, U7, U8, U10, U12	U4, U5, U6, U9 U11, U13, U14
2-3-0700-028	A	RS232C	RS232C	RS232C	RS232C	J8, J9, J12, J15(PINS 1 & 2) J13, J14, J16, J17(NONE)	U2, U4, U9, U10	U5, U6, U7, U8, U11, U12, U13, U14

REV	DATE	DRN	DESCRIPTION	CHKD	APPD
G	9-12-05	HM	ECO-XX-5001095	EM	HS
F	10-28-04	DLT	ECO-XX-5000256	EM	DLT
E	6-16-04	DLT	ECO-XX-207756	EM	DLT
D	4-13-04	HM	ECO-XX-202454	EM	HS
C	12-5-03	HM	ECO-XX-181318	EM	HS
B	02/26/02	RD	ERO YY-10078	EM	DLT
A	02/19/02	RD	NOT RELEASED	EM	DLT

SI METRIC
THIRD ANGLE PROJECTION
MATERIAL: SEE ORDER
FINISH: SEE ORDER
PROJ. FILE NO. – NONE

FILENAME: CE20765G1.DWG, DATE: 09-08-05, TIME: 1:31 P.M.

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GEOMETRIC TOLERANCES & DIMENSIONS PER ANSI Y14.5 LATEST REVISION

UNLESS OTHERWISE NOTED ALL DIMENSIONS IN INCHES
X.XX ±.015
X.XXX ±.005
ANGULAR ±0° 30'
FINISH 200 RA MAX

BREAK ALL SHARP CORNERS TO .003–.015 RADIUS AND REMOVE ALL BURRS

EMERSON Process Management

TITLE: ASSEMBLY CPU BOARD 2350A/700

DRN RD	DATE 12-27-01	DWG NO. CE-20765	REV G
CHKD EM	DATE 1-25-02		
APPD DLT	DATE 1-25-02	SCALE NTS P/N SEE ORDER	SHT 1 OF 2

2350A CPU COMMUNICATION PORT CONFIGURATIONS

IC PLACEMENT

	SET FOR RS-232		SET FOR RS-422		SET FOR RS-485	
	IC INSTALLED	IC NOT INSTALLED	IC INSTALLED	IC NOT INSTALLED	IC INSTALLED	IC NOT INSTALLED
COM 1	U2	U5, U6	U5, U6	U2	U6	U2, U5
COM 2	U9	U11, U12	U11, U12	U9	U12	U9, U11
COM 3	U4	U7, U8	U7, U8	U4	U8	U4, U7
COM 4	U10	U13, U14	U13, U14	U10	U14	U10, U13

JUMPER PLACEMENT

COM 1	**J8**	**J13**	**J8**	**J13**	**J8**	**J13**
	1 - 2	NONE	1 - 2	NONE	1 - 2	2 - 3
COM 2	**J9**	**J16**	**J9**	**J16**	**J9**	**J16**
	1 - 2	NONE	1 - 2	NONE	1 - 2	2 - 3
COM 3	**J12**	**J14**	**J12**	**J14**	**J12**	**J14**
	1 - 2	NONE	1 - 2	NONE	1 - 2	2 - 3
COM 4	**J15**	**J17**	**J15**	**J17**	**J15**	**J17**
	1 - 2	NONE	1 - 2	NONE	1 - 2	2 - 3

SI METRIC

THIRD ANGLE PROJECTION

MATERIAL: SEE ORDER

FINISH: SEE ORDER

PROJ. FILE NO. – NONE

REV	DATE	DRN	DESCRIPTION	CHKD	APPD
G	9-12-05	HM	ECO-XX-5001095	EM	HS
F	10-28-04	DLT	ECO-XX-5000256	EM	DLT
E	6-16-04	DLT	ECO-XX-207756	EM	DLT
D	4-13-04	HM	ECO-XX-202454	EM	HS
C	12-5-03	HM	ECO-XX-181318	EM	HS

FILENAME: CE20765G2.DWG, DATE: 09-08-05, TIME: 1:38 P.M.

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GEOMETRIC TOLERANCES & DIMENSIONS PER ANSI Y14.5 LATEST REVISION

UNLESS OTHERWISE NOTED ALL DIMENSIONS IN INCHES
X.XX ±.015
X.XXX ±.009
ANGULAR ±0° 30'
FINISH 200 RA MAX

BREAK ALL SHARP CORNERS TO .003-.015 RADIUS AND REMOVE ALL BURRS

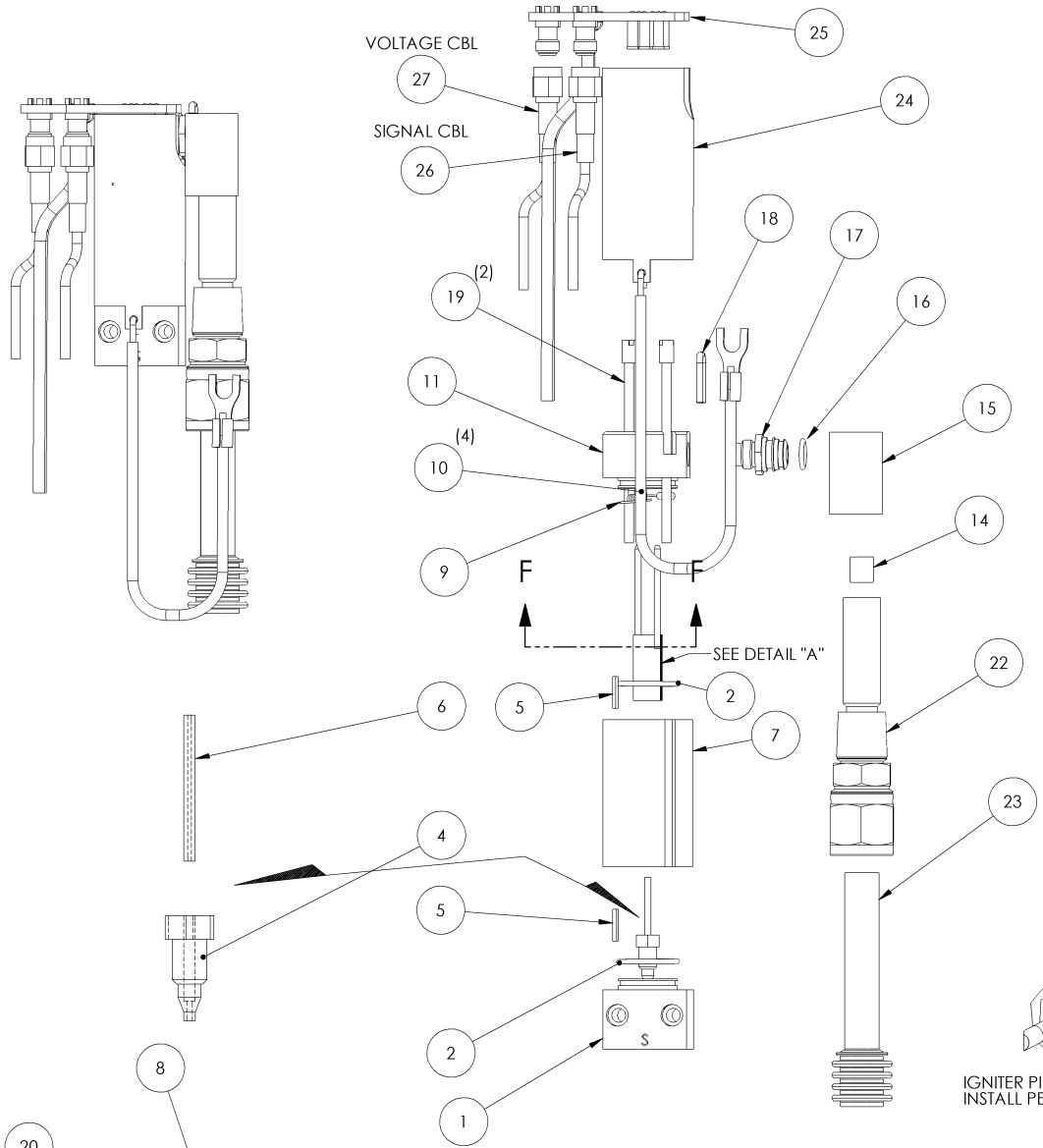
EMERSON. Process Management

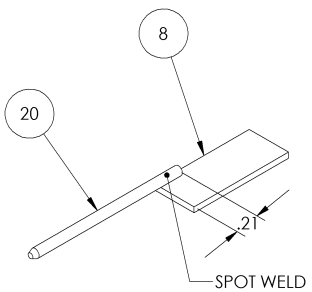
TITLE: ASSEMBLY CPU BOARD 2350A\700

DRN	MANCHA	DATE	12-5-03
CHKD	EM	DATE	12-5-03
APPD	HS	DATE	12-5-03

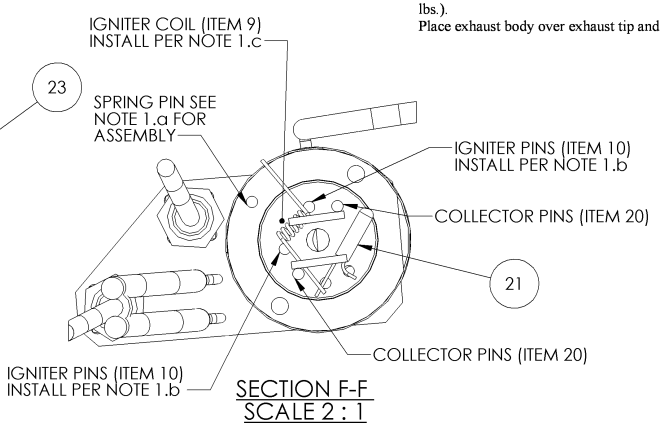
DWG NO. CE-20765 REV G

SCALE NTS P/N SEE ORDER SHT 2 OF 2





DETAIL "A"
TWO REQ'D.



SECTION F-F
SCALE 2 : 1

NOTES:

1. Build cap assembly:
   a. Press spring pin (Item 5) into hole in shoulder face of cap (Item 11).
   b. From the smaller diameter end of the cap, press 4 igniter pins (Item 10) into their holes. The tapered ends go first. The ends stop flush with the opposite surface of the cap.
   c. Weld the igniter coil (Item 9) to the ends of the igniter pins farthest from the flat face. Coils rise above the pins. Trim off excess coil wire. Ensure coils are separated. Weld RTD (item 21) to the ends of the remaining pins. Trim off excess wire. Check both devices for continuity.
   d. Weld collector plate (Item 8) to collector pin (Item 20) per "Detail A" press the collector plate assemblies into their holes in the cap using an installation fixture. Apply pressure only to the ends of the pins and not to the plates. The free ends of the collector plate pins stop flush with the opposite surface of the cap. The inner surfaces should be parallel and .220" apart.
   e. Thoroughly degrease assembly with methanol and bake dry at 75 deg C.
   f. Very lightly lubricate o-ring (Item 2) with Petroleum based grease, wipe off excess and install on smaller diameter end.

2. Build base assembly:
   a. Press spring pin (Item 5) into its hole next to cylindrical end of base (Item 1).
   b. Screw flame tip isolator (Item 4) into cylindrical end of base, lightly. Insert flame tip (Item 6) into isolator. Press into hole until it bottoms. Torque assembly only enough to seat and retain flame tip (2-5 In-lbs.).
   c. Degrease and bake as with cap.
   d. Lubricate, wipe and install o-ring (Item 2) in groove in cylindrical end.

3. Place body (Item 7) on base. Its internal baffle will surround the flame Tip. Align the hole in the body with the spring pin. Wiggling the body while pressing to the base will help the body seat fully over the o-ring.

4. Put cap in place on body. Align the spring pin with the hole in the body. Wiggle parts while assembling to seat over the o-ring. Install long screws (Item 19) and tighten (2-3 in-lbs).

5. Place shield (Item 24) over FID.

6. Lubricate o-ring (Item 16) and install on exhaust tip (Item 17). Screw Exhaust tip into cap. Tighten enough to seat (3-6 in lbs.). With all openings plugged, assembly should hold 5 psig without leaking.

7. Apply Teflon tape (9-9960-039) to fitting end (Item 22). Press flame arrester pellet (Item 14) fully into fitting end. Screw fitting into exhaust body (Item 15) (15-20 in-lbs.).
   Place exhaust body over exhaust tip and retain with clip (Item 18).

SI METRIC						
THIRD ANGLE PROJECTION						
MATERIAL: SEE ORDER						
FINISH: N/A						
PROJ. FILE NO. G-00001	B	8-19-05	DLT	ECO-XX-5001017	EM	BLB
	A	8-12-05	HM	REL'D ECO-XX-5000240	DLT	BLB
	REV	DATE	DRN	DESCRIPTION	CHKD	APPD
	FILE NAME: CE21276B1.SLDDRW, DATE: 8-19-05, TIME: 11:00 A.M.					

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GEOMETRIC TOLERANCES & DIMENSIONS PER ANSI Y14.5 LATEST REVISION

UNLESS OTHERWISE NOTED ALL DIMENSIONS IN INCHES

X.XX	±.015
X.XXX	±.005
ANGULAR	±0° 30'
FINISH	200 RA MAX

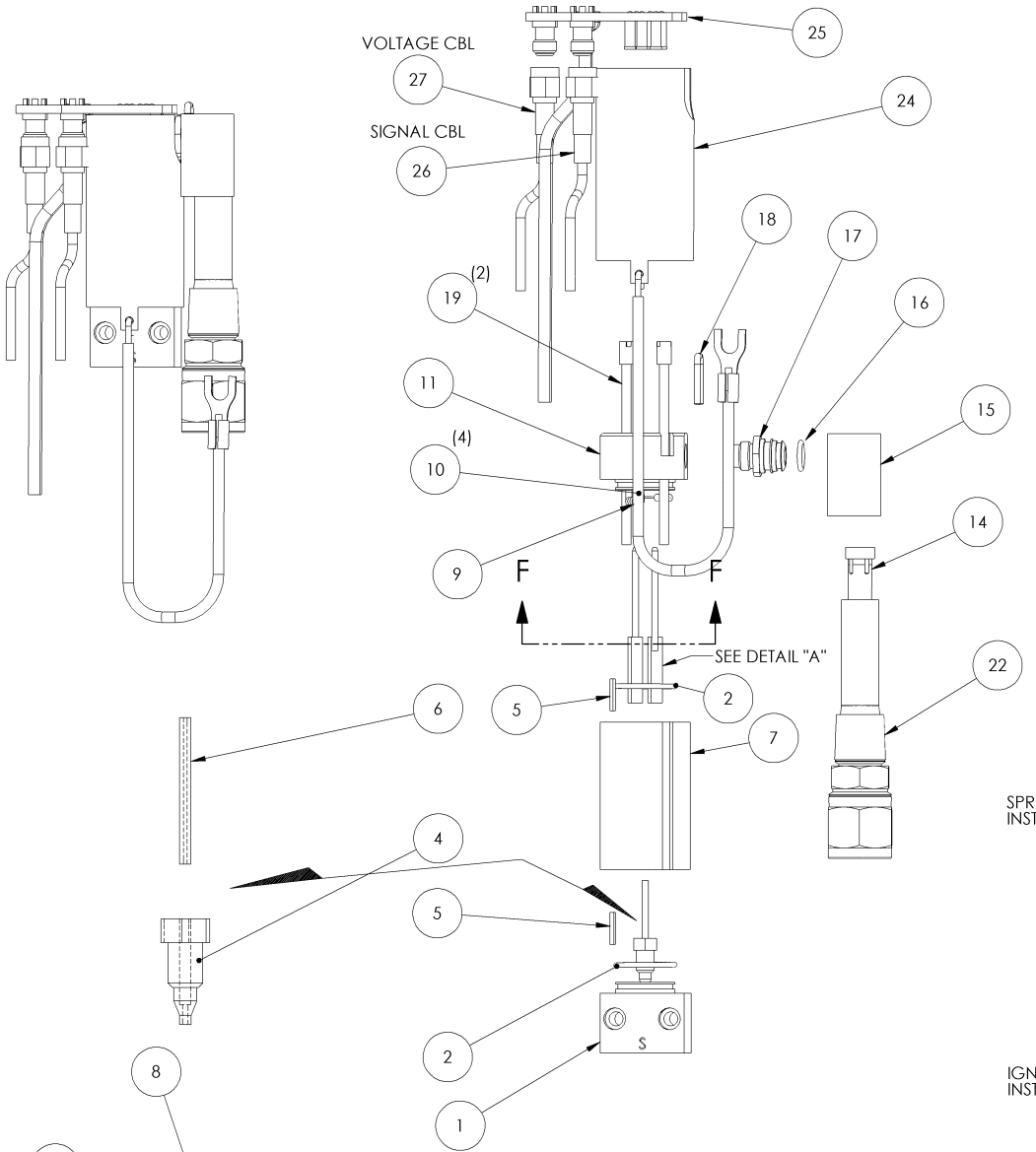
BREAK ALL SHARP CORNERS TO .003-.015 RADIUS AND REMOVE ALL BURRS

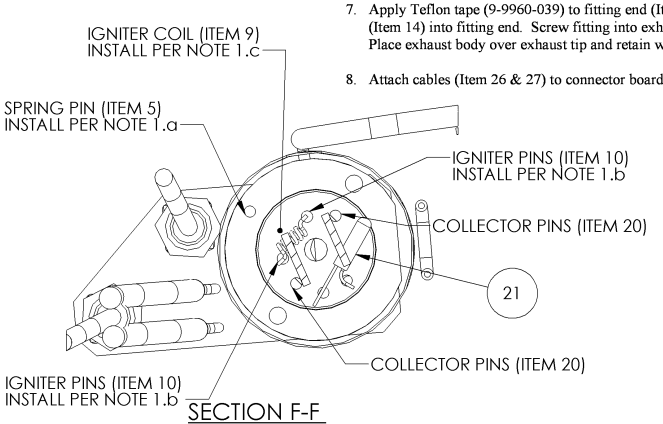
EMERSON. Process Management

TITLE

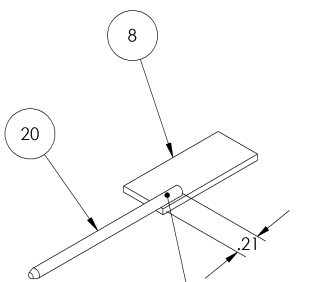
ASSEMBLY MICRO-FID MODEL 700 G.C.

DRN MANCHA	DATE 10/25/04	DWG NO. CE-21276	REV B
CHKD DLT	DATE 8/12/05		
APPD BLB	DATE 8/12/05	SCALE 1:2	P/N 2-3-0700-131 SHT 1 OF 1





SECTION F-F
SCALE 2 : 1



DETAIL "A"
TWO REQ'D.

NOTES:

1. Build cap assembly:
   a. Press spring pin (Item 5) into hole in shoulder face of cap (Item 11).
   b. From the smaller diameter end of the cap, press 4 igniter pins (Item 10) into their holes. The tapered ends go first. The ends stop flush with the opposite surface of the cap.
   c. Weld the igniter coil (Item 9) to the ends of the igniter pins farthest from the flat face. Coil should be below top of pins. Trim off excess coil wire. Ensure coils are separated. Weld RTD (item 21) to the ends of the remaining pins. Trim off excess wire. Check both devices for continuity.
   d. Weld collector plate (Item 8) to collector pin (Item 20) per "Detail A" press the collector plate assemblies into their holes in the cap using an installation fixture. Apply pressure only to the ends of the pins and not to the plates. The free ends of the collector plate pins stop flush with the opposite surface of the cap. The inner surfaces should be parallel and .220" apart.
   e. Thoroughly degrease assembly with methanol and bake dry at 75 deg C.
   f. Very lightly lubricate o-ring (Item 2) with Petroleum based grease, wipe off excess and install on smaller diameter end.

2. Build base assembly:
   a. Press spring pin (Item 5) into its hole next to cylindrical end of base (Item 1).
   b. Screw flame tip isolator (Item 4) into cylindrical end of base, lightly. Insert flame tip (Item 6) into isolator. Press into hole until it bottoms. Torque assembly only enough to seat and retain flame tip (2-5 In-lbs.).
   c. Degrease and bake as with cap.
   d. Lubricate, wipe and install o-ring (Item 2) in groove in cylindrical end.

3. Place body (Item 7) on base. Its internal baffle will surround the flame Tip. Align the hole in the body with the spring pin. Wiggling the body while pressing to the base will help the body seat fully over the o-ring.

4. Put cap in place on body. Align the spring pin with the hole in the body. Wiggle parts while assembling to seat over the o-ring. Install long screws (Item 19) and tighten (2-3 in-lbs).

5. Place shield (Item 24) over FID.

6. Lubricate o-ring (Item 16) and install on exhaust tip (Item 17). Screw Exhaust tip into cap. Tighten enough to seat (3-6 in lbs.). With all openings plugged, assembly should hold 5 psig without leaking.

7. Apply Teflon tape (9-9960-039) to fitting end (Item 22). Install flame gap pin (Item 14) into fitting end. Screw fitting into exhaust body (Item 15) (15-20 in-lbs.). Place exhaust body over exhaust tip and retain with clip (Item 18).

8. Attach cables (Item 26 & 27) to connector board (Item 25). Install on assembly.

SI METRIC						
THIRD ANGLE PROJECTION						
MATERIAL: SEE ORDER	D	2-17-06	HM	ECO-XX-5001513	EM	DLT
	C	10-6-05	HM	ECO-XX-5001141	EM	BLB
	B	8-19-05	HM	ECO-XX-5001017	EM	BLB
	A	8-12-05	HM	REL'D ECO-XX-5000240	DLT	BLB
FINISH: N/A	REV	DATE	DRN	DESCRIPTION	CHKD	APPD
PROJ. FILE NO. G-00001	FILE NAME: CE21276D1.SLDDRW, DATE: 1-27-06, TIME: 10:25 A.M.					

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GEOMETRIC TOLERANCES & DIMENSIONS PER ANSI Y14.5 LATEST REVISION

UNLESS OTHERWISE NOTED ALL DIMENSIONS IN INCHES

X.XX	±.015
X.XXX	±.005
ANGULAR	±0° 30'
FINISH	200 RA MAX

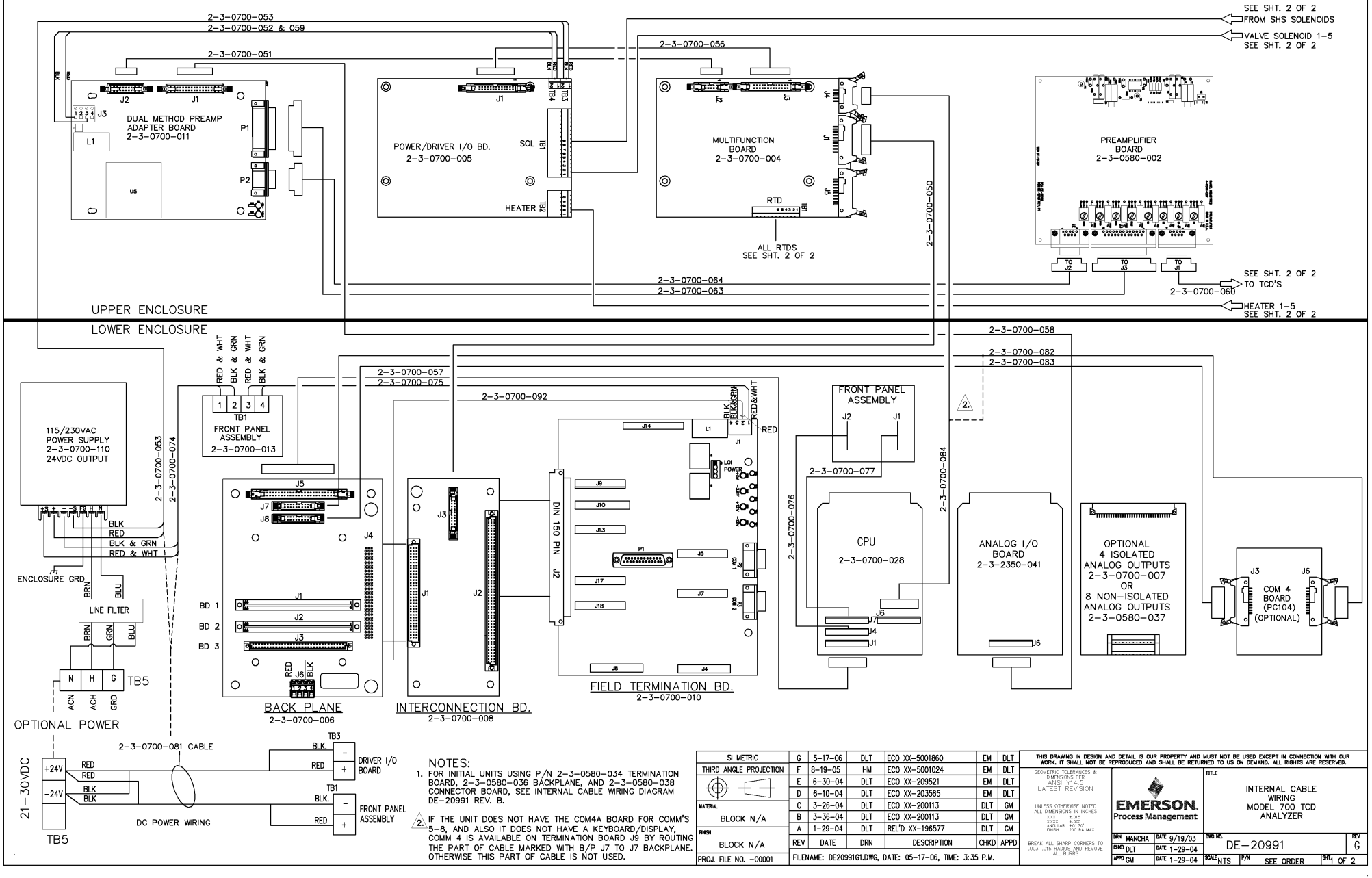
BREAK ALL SHARP CORNERS TO .003-.015 RADIUS AND REMOVE ALL BURRS

EMERSON. Process Management

TITLE

ASSEMBLY MICRO-FID MODEL 700 G.C.

DRN MANCHA	DATE 10/25/04	DWG NO. CE-21276		REV D	
CHKD DLT	DATE 8/12/05				
APPD BLB	DATE 8/12/05	SCALE 1:2	P/N 2-3-0700-131	SHT 1 OF 1	



NOTES:

1. FOR INITIAL UNITS USING P/N 2-3-0580-034 TERMINATION BOARD, 2-3-0580-036 BACKPLANE, AND 2-3-0580-038 CONNECTOR BOARD, SEE INTERNAL CABLE WIRING DIAGRAM DE-20991 REV. B.
2. IF THE UNIT DOES NOT HAVE THE COM4A BOARD FOR COMM'S 5-8, AND ALSO IT DOES NOT HAVE A KEYBOARD/DISPLAY, COMM 4 IS AVAILABLE ON TERMINATION BOARD J9 BY ROUTING THE PART OF CABLE MARKED WITH B/P J7 TO J7 BACKPLANE. OTHERWISE THIS PART OF CABLE IS NOT USED.

REV	DATE	DRN	DESCRIPTION	CHKD	APPD
G	5-17-06	DLT	ECO XX-5001860	EM	DLT
F	8-19-05	HM	ECO XX-5001024	EM	DLT
E	6-30-04	DLT	ECO XX-209521	EM	DLT
D	6-10-04	DLT	ECO XX-203565	EM	DLT
C	3-26-04	DLT	ECO XX-200113	DLT	GM
B	3-36-04	DLT	ECO XX-200113	DLT	GM
A	1-29-04	DLT	REL'D XX-196577	DLT	GM

SI METRIC | THIRD ANGLE PROJECTION | MATERIAL: BLOCK N/A | FINISH: BLOCK N/A | PROJ. FILE NO. -00001

FILENAME: DE20991G1.DWG, DATE: 05-17-06, TIME: 3:35 P.M.

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GEOMETRIC TOLERANCES & DIMENSIONS PER ANSI Y14.5 LATEST REVISION

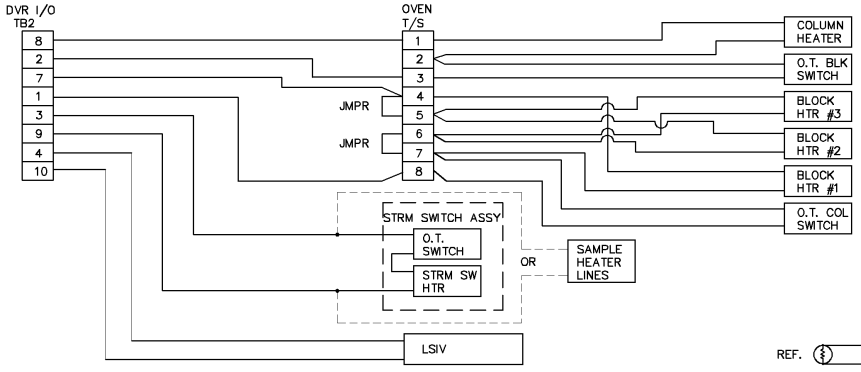
UNLESS OTHERWISE NOTED ALL DIMENSIONS IN INCHES
XXX ±.015
XXX ±.005
ANGULAR ±0° 30'
FINISH 200 RA MAX

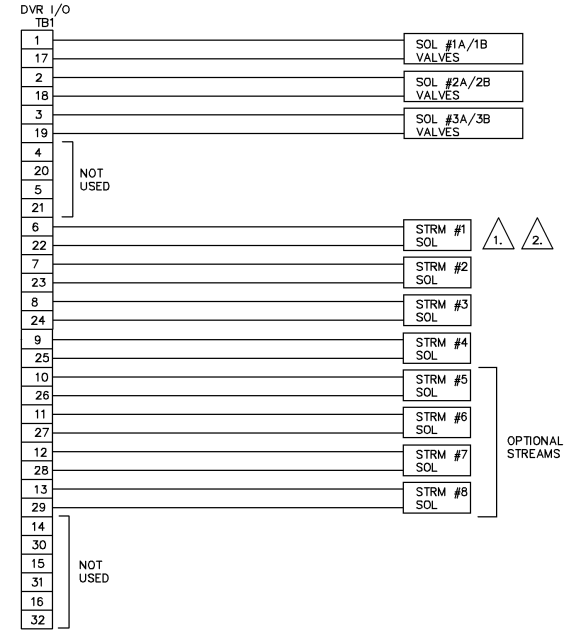
BREAK ALL SHARP CORNERS TO .003-.015 RADIUS AND REMOVE ALL BURRS

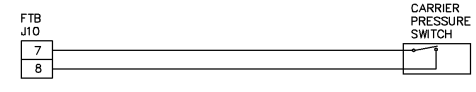
EMERSON. Process Management

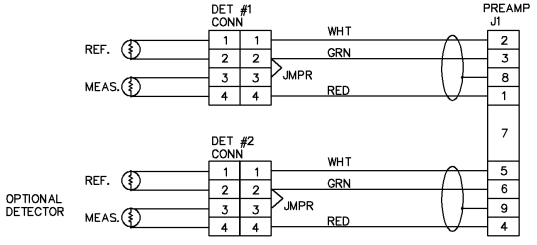
TITLE: INTERNAL CABLE WIRING MODEL 700 TCD ANALYZER

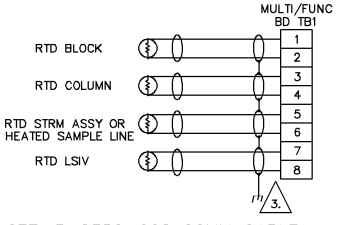
DRN MANCHA	DATE 9/19/03	DWG NO. DE-20991	REV G
CHKD DLT	DATE 1-29-04		
APPD GM	DATE 1-29-04	SCALE NTS P/N SEE ORDER	SHT 1 OF 2



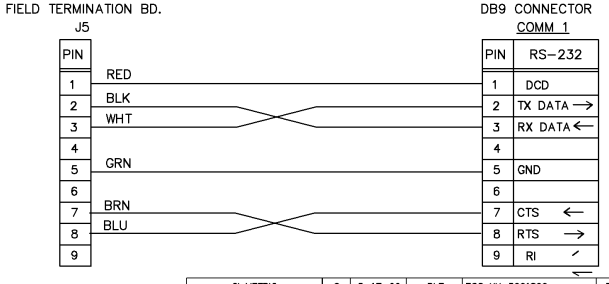


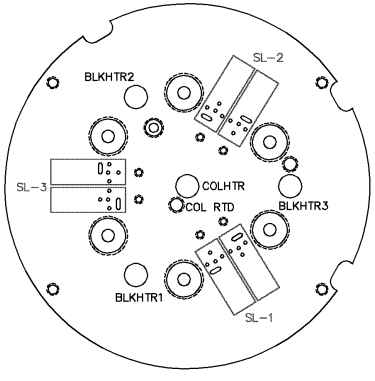




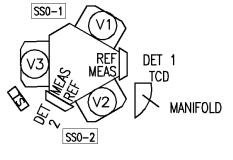


WIRING 6FT. 3-2350-068 COMM CABLE





KIOSK MANIFOLD BOTTOM VIEW



TOP VIEW OF ANALYZER OVEN FROM FRONT

NOTES:

1. CALIBRATE IS THE LAST STREAM USED.
2. IF THE STREAM SWITCHING IS DOUBLE BLOCK AND BLEED, THERE ARE TWO SOLENOIDS FOR EACH STREAM WIRED IN PARALLEL.
3. CONNECT SHIELDS TO MOUNTING SCREW OF OVEN MOUNTING PLATE.

REV	DATE	DRN	DESCRIPTION	CHKD	APPD
G	5-17-06	DLT	ECO XX-5001860	EM	DLT
F	8-19-05	HM	ECO XX-5001024	EM	DLT
E	6-30-04	DLT	ECO XX-209521	EM	DLT
D	6-10-04	DLT	ECO XX-203565	EM	DLT
C	3-26-04	DLT	ECO XX-200113	DLT	GM
B	3-26-04	DLT	ECO XX-200113	DLT	GM
A	1-29-04	DLT	REL'D XX-196577	DLT	GM

SI METRIC
THIRD ANGLE PROJECTION
MATERIAL: BLOCK N/A
FINISH: BLOCK N/A
PROJ. FILE NO. G-00001
FILENAME: DE20991G2.DWG, DATE: 05-17-06, TIME: 3:41 P.M.

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GEOMETRIC TOLERANCES & DIMENSIONS PER ANSI Y14.5 LATEST REVISION

UNLESS OTHERWISE NOTED ALL DIMENSIONS IN INCHES
X.XX ±.015
X.XXX ±.005
ANGULAR ±0° 30'
FINISH 200 RA MAX

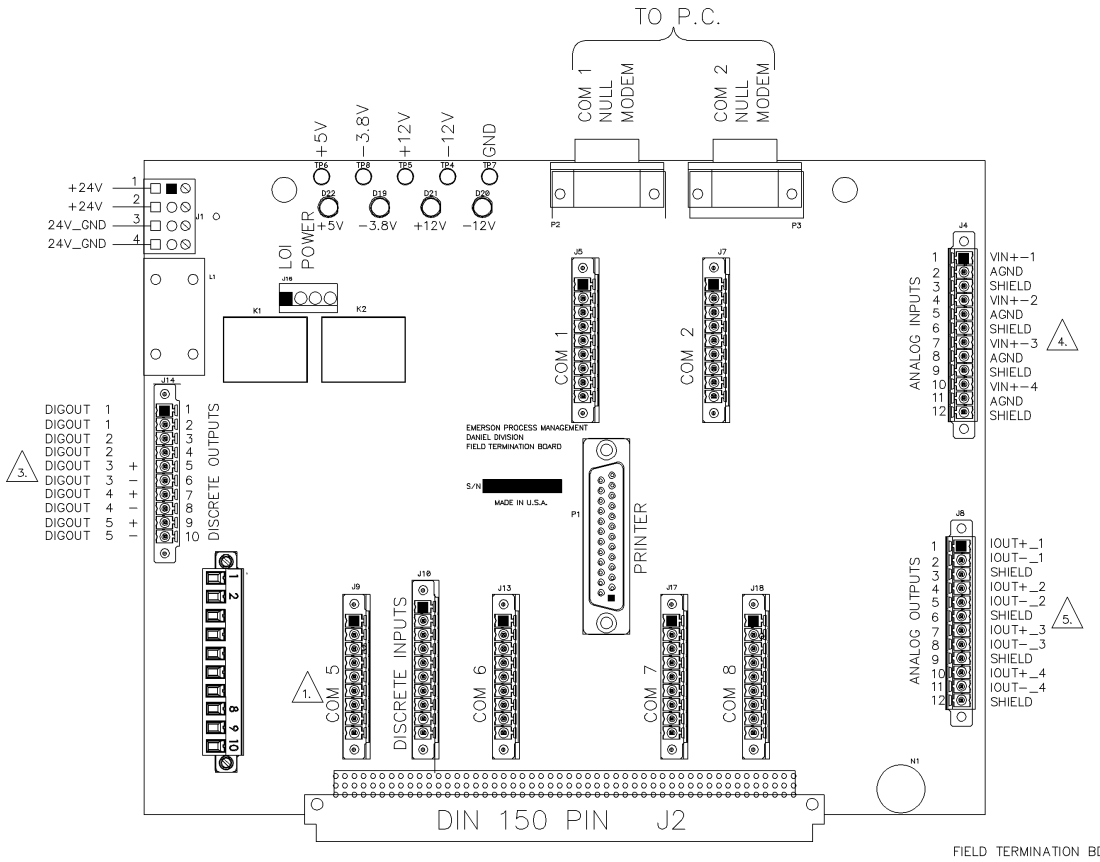
BREAK ALL SHARP CORNERS TO .003-.015 RADIUS AND REMOVE ALL BURRS

EMERSON. Process Management

TITLE: INTERNAL CABLE WIRING MODEL 700 TCD ANALYZER

DRN	MANCHA	DATE	8/19/03
CHKD	DLT	DATE	1-29-04
APPD	GM	DATE	1-29-04

DWG NO. DE-20991 REV G
SCALE NTS P/N SEE ORDER SHT 2 OF 2

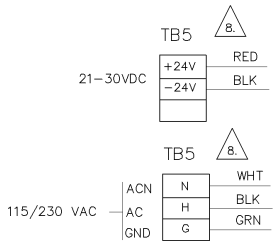


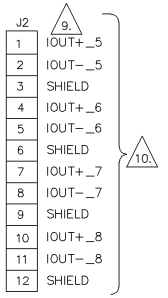
FIELD TERMINATION BOARD

NOTES:

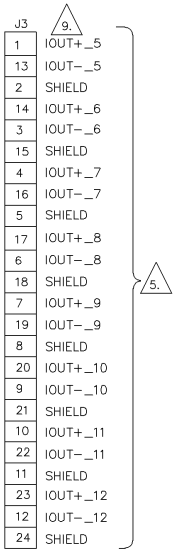
FOR INITIAL UNITS USING P/N 2−3−0580−034 TERMINATION BOARD, SEE FIELD WIRING DIAGRAM DE−20992 REV. B OR EARLIER.

1. IF THE UNIT DOES NOT HAVE THE COM4A BOARD FOR COMMS 5 −8, COMM 4 IS AVAILABLE ON J9. WITH THE COM 4A BOARD INSTALLED, COM 5 IS AVAILABLE ON J9.
2. DISCRETE INPUTS REQUIRE A ISOLATED CONTACT OR OPEN COLLECTOR INPUT. OPEN CIRCUIT VOLTAGE IS 12VDC WITH A 5K OHM RESISTANCE.
3. DISCRETE OUTPUTS 1 AND 2 ARE NORMALLY OPEN RELAY CONTACTS WITH A RATING OF 1A @ 30VDC. ANY INDUCTANCE LOAD SHOULD HAVE TRANSIENT SUPPRESSION. DISCRETE OUTPUTS 3 THROUGHT 5 ARE SOLID STATE SWITCHES WITH A RATING OF 0.375A @ 30VDC AND HAVE A 36V ZENER TRANSIENT SUPPRESSOR ACROSS OUTPUTS.
4. ANALOG INPUTS ARE 4−20MA. THE LOW SIDE IS CONNECTED ANALOG GND. TOTAL INTERNAL RESISTANCE IS 249 OHMS.
5. ANALOG OUTPUTS ARE NON−ISOLATED 4−20MA. THE LOW SIDE IS CONNECTED TO ANALOG GND THROUGH A 15 OHM RESISTOR. RECEIVING DEVICE REQUIRES A DIFFERENTIAL INPUT. OPEN CIRCUIT VOLTAGE IS 11VDC. MAX. EXTERNAL LOAD AT 20MA IS 550 OHMS MINUS 52.1 INTERNAL RESISTANCE MINUS EXTERNAL WIRING RESISTANCE.
6. ALL INPUTS AND OUTPUTS ARE TRANSIENT PROTECTED EXCEPT FOR THE TWO RELAY CONTACT OUTPUTS DIGOUT 1 AND DIGOUT 2.
7. SIX FOOT SERIAL COMMUNICATION CABLE, WIRED TO FIELD TERMINATION BOARD J5, SUPPLIED WITH EACH UNIT.
8. POWER TERMINAL STRIP IS LOCATED ON POWER SUPPLY MOUNTING BRACKET IN LOWER ENCLOSURE.
9. OPTIONAL 8 ANALOG BOARD OR OPTIONAL 4 ISOLATED ANALOG BOARD LOCATED IN LOWER SLOT OF CARDCAGE IN LOWER ENCLOSURE. TERMINAL STRIP IS LOCATED ON FRONT EDGE OF BOARD.
10. OPTIONAL ISOLATED 4 ANALOG OUTPUT BOARD PROVIDES 24 VOLTS LOOPBACK POWER FOR EACH OUPUT. ALL OUTPUTS ARE COMPLETELY ISOLATED FROM EACH OTHER. THE OPEN CIRCUIT VOLTAGE IS 24V. THE MAXIMUM LOAD AT 20mA IS 1.2K OHMS MINUS 40.5 OHMS INTERNAL RESISTANCE MINUS EXTERNAL WIRING RESISTANCE.





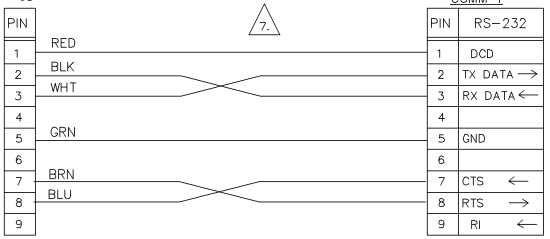
ISOLATED ANALOG OUTPUT BOARD



NON−ISOLATED ANALOG OUTPUT BOARD

COMMUNICATION CONNECTIONS

FIELD TERMINATION BD. J5 — DB9 CONNECTOR COMM 1



COMMUNICATION CONNECTIONS

J5, J7, J9, J13, J17, & J18 — 1.

PIN	RS−232	RS−485	RS−422
1	DCD	N/C	N/C
2	RX DATA ←	RX/TX+	TX+
3	TX DATA →	RX/TX−	TX−
4	DTR →	N/C	N/C
5	GND	GND	GND
6	DSR ←	N/C	RX+
7	RTS →	N/C	RX−
8	CTS ←	N/C	N/C
9	RI ←	N/C	N/C

COMMUNICATION CONNECTIONS

P2 AND P3 (NULL MODEM) COMM 1, & 2

PIN	RS−232
1	DCD
2	TX DATA →
3	RX DATA ←
4	DSR ←
5	GND
6	DTR →
7	CTS ←
8	RTS →
9	RI ←

DISCRETE INPUTS 2.

J10 CONNECTOR

PIN	RS−232
1	DIG_IN1
2	GND
3	DIG_IN2
4	GND
5	DIG_IN3
6	GND
7	DIG_IN4
8	GND
9	DIG_IN5
10	GND

CARRIER PRESSURE SWITCH (OPTIONAL)

REV	DATE	DRN	DESCRIPTION	CHKD	APPD
F	10−13−04	HM	ECO XX−5000196	EM	DLT
E	8−10−04	DLT	ECO XX−5000003	DLT	GM
D	6−10−04	HM	ECO XX−203565	EM	DLT
C	3−23−04	DLT	ECO XX−200113	DLT	GM
B	3−8−04	DLT	ECO XX−199533	EM	DLT
A	1−29−04	HM	REL'D XX−196577	DLT	GM
2	12−17−03	HM	REV. DISCRETE INPUTS	DLT	GM

SI METRIC; THIRD ANGLE PROJECTION; MATERIAL: BLOCK N/A; FINISH: BLOCK N/A; PROJ. FILE NO. G−00001

GEOMETRIC TOLERANCES & DIMENSIONS PER ANSI Y14.5 LATEST REVISION

UNLESS OTHERWISE NOTED ALL DIMENSIONS IN INCHES
X.XX ±.005
X.XXX ±.002
ANGULAR ±0.30'
FINISH 200 RA MAX

BREAK ALL SHARP CORNERS TO .003−.015 RADIUS AND REMOVE ALL BURRS.

FILENAME: DE20992F1.DWG, DATE: 10−12−04, TIME: 1:16 P.M.

THIS DRAWING IN DESIGN AND DETAIL IS OUR PROPERTY AND MUST NOT BE USED EXCEPT IN CONNECTION WITH OUR WORK. IT SHALL NOT BE REPRODUCED AND SHALL BE RETURNED TO US ON DEMAND. ALL RIGHTS ARE RESERVED.

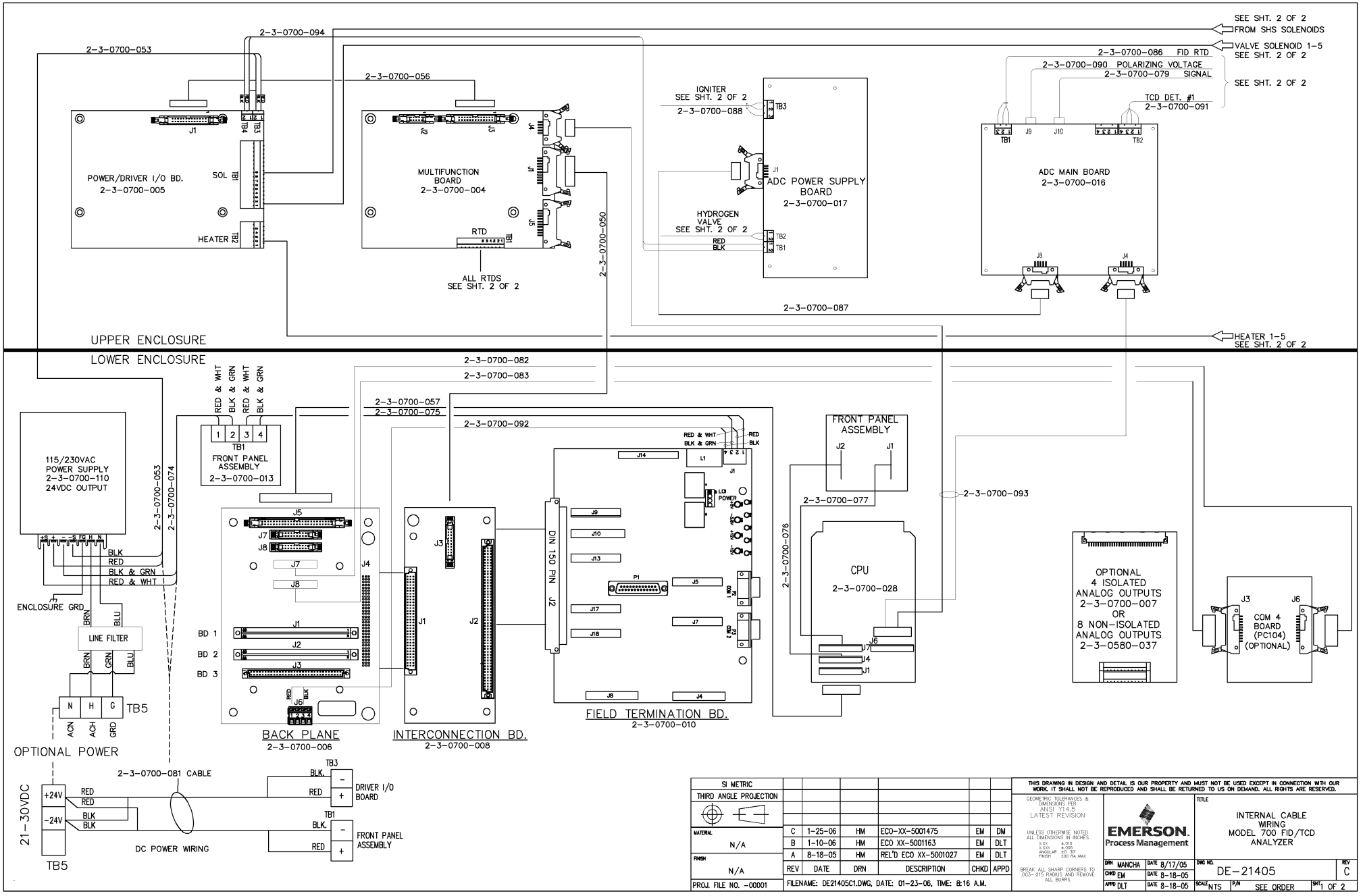
EMERSON. Process Management

DRN DLT	DATE 9/2/03	
CHKD DLT	DATE 1−29−04	
APPD GM	DATE 1−29−04	

TITLE: FIELD WIRING MODEL 700 G.C.

DWG NO. DE−20992 REV F

SCALE NTS P/N N/A SHT 1 OF 1



C	1-25-06	HM	ECO-XX-5001475	EM	DM
B	1-10-06	HM	ECO XX-5001163	EM	DLT
A	8-18-05	HM	REL'D ECO XX-5001027	EM	DLT
REV	DATE	DRN	DESCRIPTION	CHKD	APPD

SI METRIC
THIRD ANGLE PROJECTION
MATERIAL N/A
FINISH N/A
PROJ. FILE NO. -00001
FILENAME: DE21405C1.DWG, DATE: 01-23-06, TIME: 8:16 A.M.

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GEOMETRIC TOLERANCES & DIMENSIONS PER ANSI Y14.5 LATEST REVISION

UNLESS OTHERWISE NOTED ALL DIMENSIONS IN INCHES
X.XX ±.015
X.XXX ±.005
ANGULAR ±.5°
FINISH 200 RA MAX

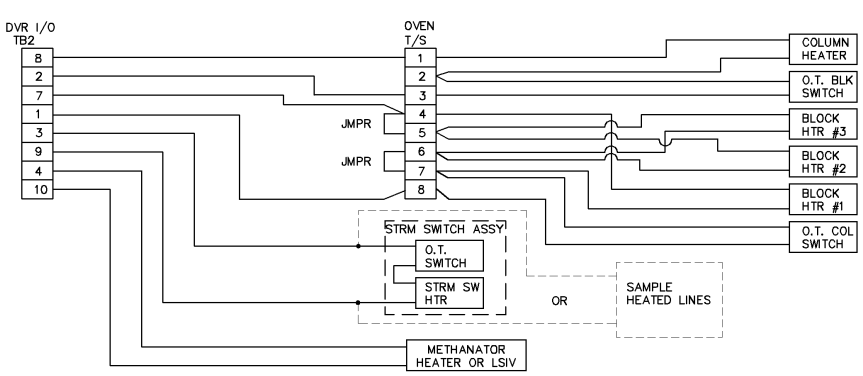
BREAK ALL SHARP CORNERS TO .003-.015 RADIUS AND REMOVE ALL BURRS

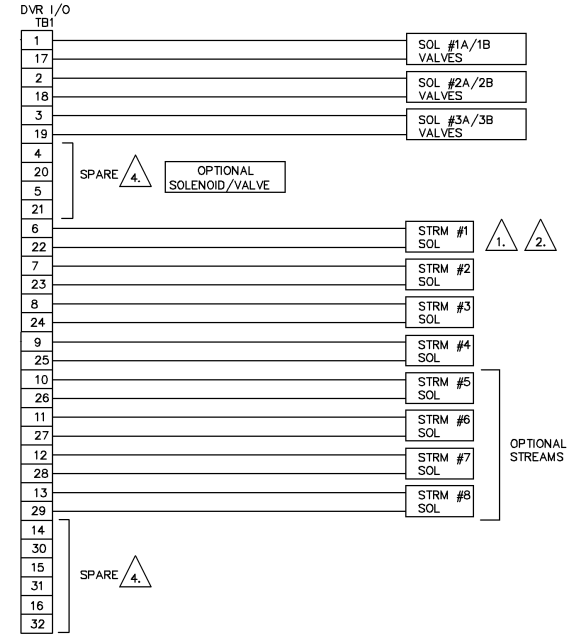
EMERSON. Process Management

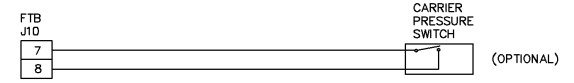
TITLE: INTERNAL CABLE WIRING MODEL 700 FID/TCD ANALYZER

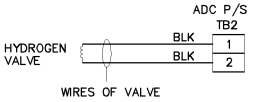
DRN	MANCHA	DATE	8/17/05
CHKD	EM	DATE	8-18-05
APPD	DLT	DATE	8-18-05

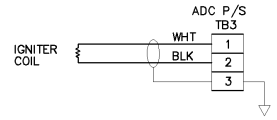
DWG NO. DE-21405 REV C
SCALE NTS P/N SEE ORDER SHT 1 OF 2

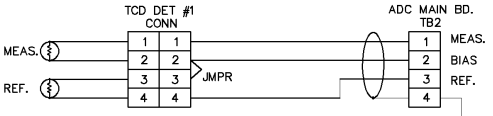


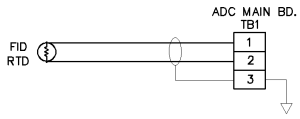


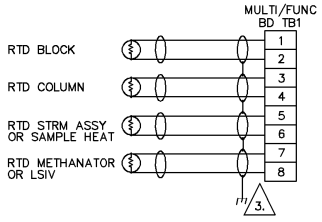






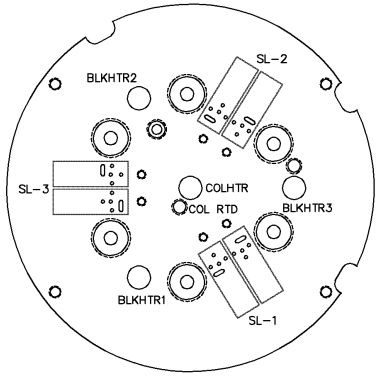






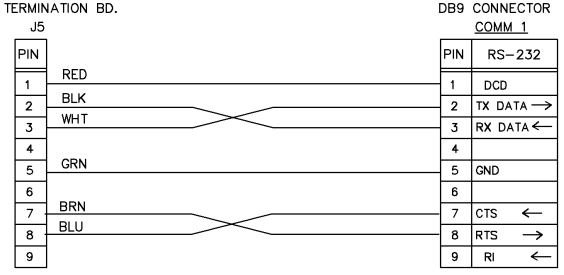
NOTES:

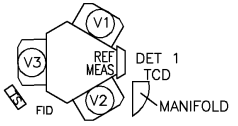
1. CALIBRATE IS THE LAST STREAM USED.
2. IF THE STREAM SWITCHING IS DOUBLE BLOCK AND BLEED, THERE ARE TWO SOLENOIDS FOR EACH STREAM WIRED IN PARALLEL.
3. CONNECT SHIELDS TO MOUNTING SCREW OF OVEN MOUNTING PLATE.
4. SEE APPLICATION FLOW DRAWING FOR WIRING.



KIOSK MANIFOLD BOTTOM VIEW

WIRING 6FT. 3-2350-068 COMM CABLE





TOP VIEW OF ANALYZER
OVEN FROM FRONT

REV	DATE	DRN	DESCRIPTION	CHKD	APPD
C	1-25-06	HM	ECO-XX-5001475	EM	DM
B	1-10-06	HM	ECO XX-5001163	EM	DLT
A	8-18-05	HM	REL'D ECO XX-5001027	EM	DLT

SI METRIC
THIRD ANGLE PROJECTION
MATERIAL N/A
FINISH N/A
PROJ. FILE NO. G-00001
FILENAME: DE21405C2.DWG, DATE: 01-23-06, TIME: 8:18 A.M.

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GEOMETRIC TOLERANCES & DIMENSIONS PER ANSI Y14.5 LATEST REVISION

UNLESS OTHERWISE NOTED ALL DIMENSIONS IN INCHES
X.XX ±.010
X.XXX ±.005
ANGULAR ±0° 30'
FINISH 200 Ra MAX

BREAK ALL SHARP CORNERS TO .003-.015 RADIUS AND REMOVE ALL BURRS

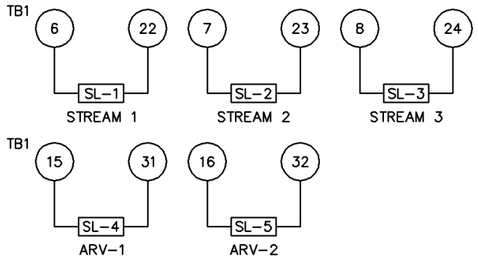
EMERSON. Process Management

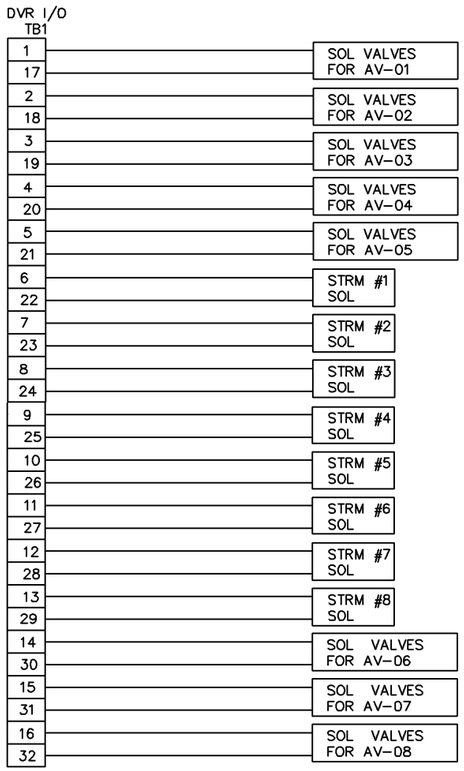
TITLE: INTERNAL CABLE WIRING MODEL 700 FID/TCD ANALYZER

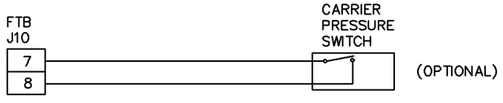
DRN MANCHA	DATE 8/17/05	DWG NO. DE-21405 REV C
CHKD EM	DATE 8-18-05	
APPD DLT	DATE 8-18-05	SCALE NTS P/N SEE ORDER SHT 2 OF 2

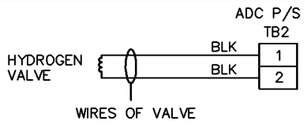
SCS SOLENOID WIRING

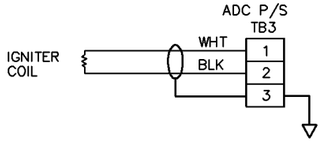
DRIVER I/O BOARD TB1 IS LOCATED IN 1700 UPPER ENCLOSURE

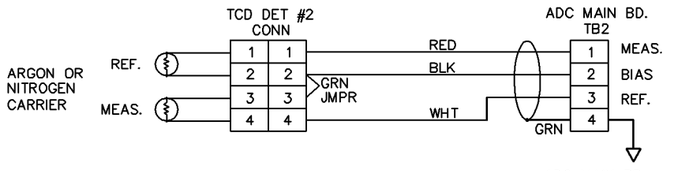


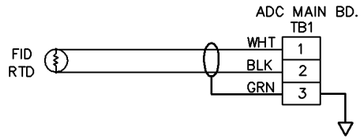


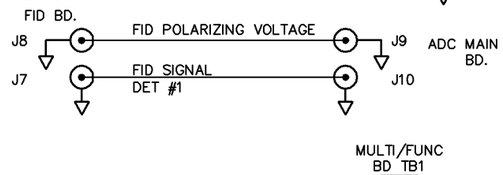


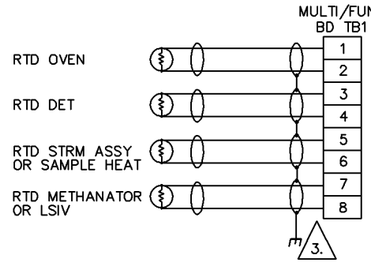




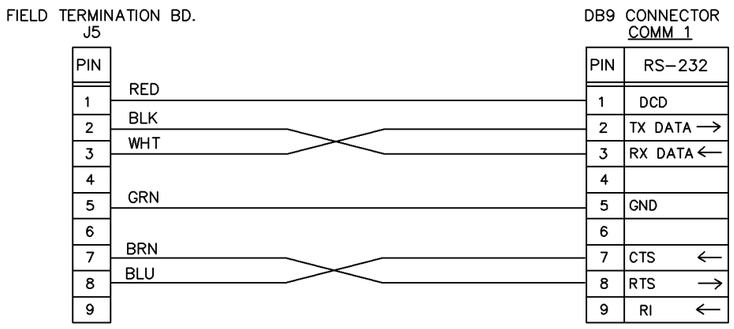






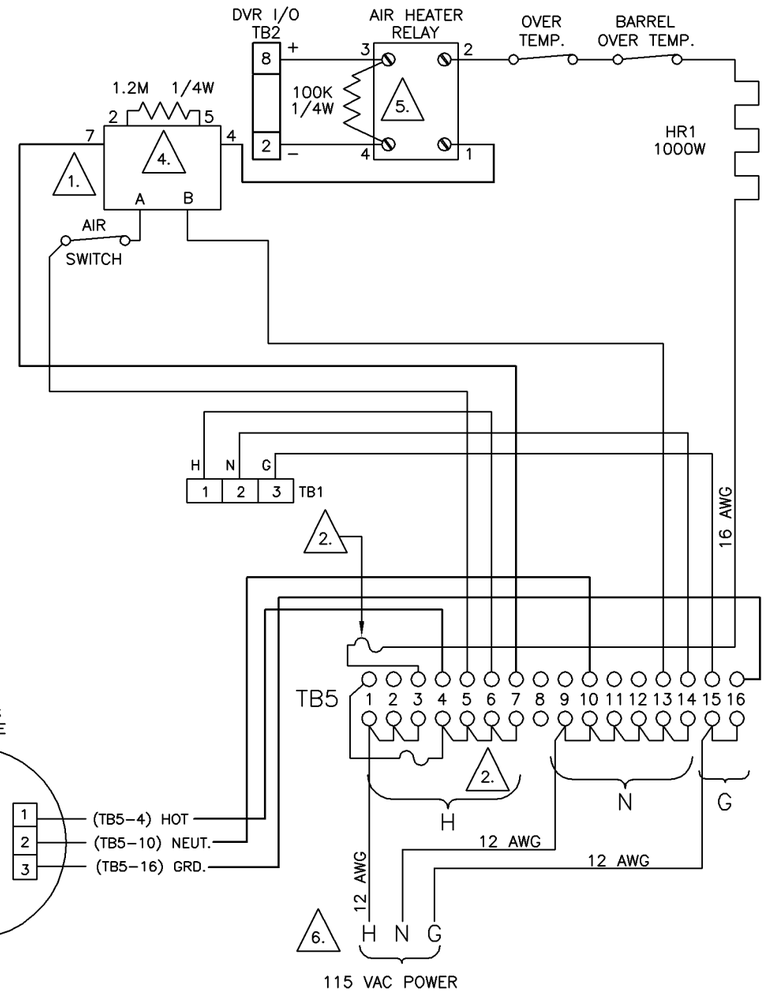


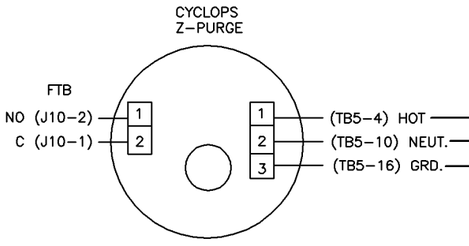
WIRING 6FT. 3-2350-068 COMM CABLE



NOTES:

1. SOLID STATE TIME DELAY RELAY 120 VAC INPUT/ 120 VAC OUTPUT EXTERNAL CONNECTIONS ARE TO BE MADE PER WIRING DIAGRAM.
2. 10 AMP FUSE P/N 5-4203-137. MANUFACTURER: LITTELFUSE #313-010.
3. ALL WIRES 18 AWG UNLESS OTHERWISE NOTED.
4. **RESISTOR, P/N 5-1212-620, INSTALLED BY ANALYZER PRODUCTION.**
5. RESISTORS, P/N 5-1212-510, INSTALLED BY ANALYZER PRODUCTION.
6. 3/4" CONDUIT CONNECTION FOR CUSTOMER.





SI METRIC						
THIRD ANGLE PROJECTION						
MATERIAL N/A						
FINISH N/A	A	10-29-07	CC	RELEASED	EM	HO
PROJ. FILE NO. G-00001	REV	DATE	DRN	DESCRIPTION	CHKD	APPD

FILENAME: DE21446A1.dwg, DATE: 10-30-07, TIME: 9:52 A.M.

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GEOMETRIC TOLERANCES & DIMENSIONS PER ANSI Y14.5 LATEST REVISION

UNLESS OTHERWISE NOTED ALL DIMENSIONS IN INCHES
X.XX ±.015
X.XXX ±.005
ANGULAR ±0° 30'
FINISH 200 RA MAX

BREAK ALL SHARP CORNERS TO .003-.015 RADIUS AND REMOVE ALL BURRS

EMERSON. Process Management

TITLE: INTERNAL CABLE WIRING ARGON/NITROGEN CARRIER (TCD) MODEL 1700 FID/TCD ANALYZER

DRN CC	DATE 7/11/07	DWG NO. DE-21446	REV A
CHKD EM	DATE 10/29/07		
APPD HO	DATE 10/29/07	SCALE NTS	P/N SEE ORDER

SHT 1 OF 2

FROM SHS SOLENOIDS

VALVE SOLENOID 1–5

2–3–0700–086 FID RTD

2–3–0700–090 POLARIZING VOLTAGE

2–3–0700–079 SIGNAL FID DET #1

SEE SHT. 1 OF 2

TCD DET. #2
2–3–0700–091

2–3–0700–094

2–3–0700–053

2–3–0700–056

POWER/DRIVER I/O BD.
2–3–0700–005

J1

SOL TB1

HEATER TB2

MULTIFUNCTION BOARD
2–3–0700–004

J2 J3 J4 J1 J5

RTD TB1

ALL RTDS
SEE SHT. 2 OF 2

2–3–0700–050

IGNITER
SEE SHT. 2 OF 2
2–3–0700–088

TB3

J1

ADC POWER SUPPLY BOARD
2–3–0700–017

HYDROGEN VALVE
SEE SHT. 2 OF 2

RED
BLK

TB2
TB1

2–3–0700–087

ADC MAIN BOARD
2–3–0700–016

J9 J10 TB1 TB2 J8 J5

2–3–0700–082

2–3–0700–083

2–3–0700–096

2–3–0700–095

2–3–0700–110
115/230VAC
POWER SUPPLY
W/AUTEX P/S
2–5–3200–038
24VDC OUTPUT

RED & WHT
BLK & GRN
RED & WHT
BLK & GRN

1 2 3 4
TB1
FRONT PANEL ASSEMBLY
2–3–0700–013

2–3–0700–057
2–3–0700–075

2–3–0700–092

RED & WHT
BLK & GRN
RED
BLK

J14 L1 J1

LOI POWER

J9 J10 J13 P1 J5 J17 J7 J18 J8 J4

P2 COM 1
P3 COM 2

DIN 150 PIN J2

FIELD TERMINATION BD.
2–3–0700–010

FRONT PANEL ASSEMBLY
J2 J1

2–3–0700–077

2–3–0700–076

2–3–0700–093

CPU
2–3–0700–028

J6 J7 J4 J1

OPTIONAL
4 ISOLATED
ANALOG OUTPUTS
2–3–0700–007
OR
8 NON–ISOLATED
ANALOG OUTPUTS
2–3–0580–037

J3 J6
COM 4
BOARD
(PC104)
(OPTIONAL)

ENCLOSURE GRD

BRN BLU
LINE FILTER
BRN GRN BLU

N H G TB5
ACN ACH GRD

BD 1
BD 2
BD 3

J5 J7 J8 J4 J1 J2 J3 J6
RED BLK
1 2 3 4

BACK PLANE
2–3–0700–006

J3 J1 J2

INTERCONNECTION BD.
2–3–0700–008

SI METRIC						
THIRD ANGLE PROJECTION						
MATERIAL N/A						
FINISH N/A	A	10–30–07	CC	RELEASED	EM	HO
PROJ. FILE NO. –00001	REV	DATE	DRN	DESCRIPTION	CHKD	APPD

FILENAME: DE21446A2.dwg, DATE: 10–29–07, TIME: 9:57 A.M.

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GEOMETRIC TOLERANCES & DIMENSIONS PER ANSI Y14.5 LATEST REVISION

UNLESS OTHERWISE NOTED ALL DIMENSIONS IN INCHES
X.XX ±.015
X.XXX ±.005
ANGULAR ±0° 30'
FINISH 200 RA MAX

BREAK ALL SHARP CORNERS TO .003–.015 RADIUS AND REMOVE ALL BURRS

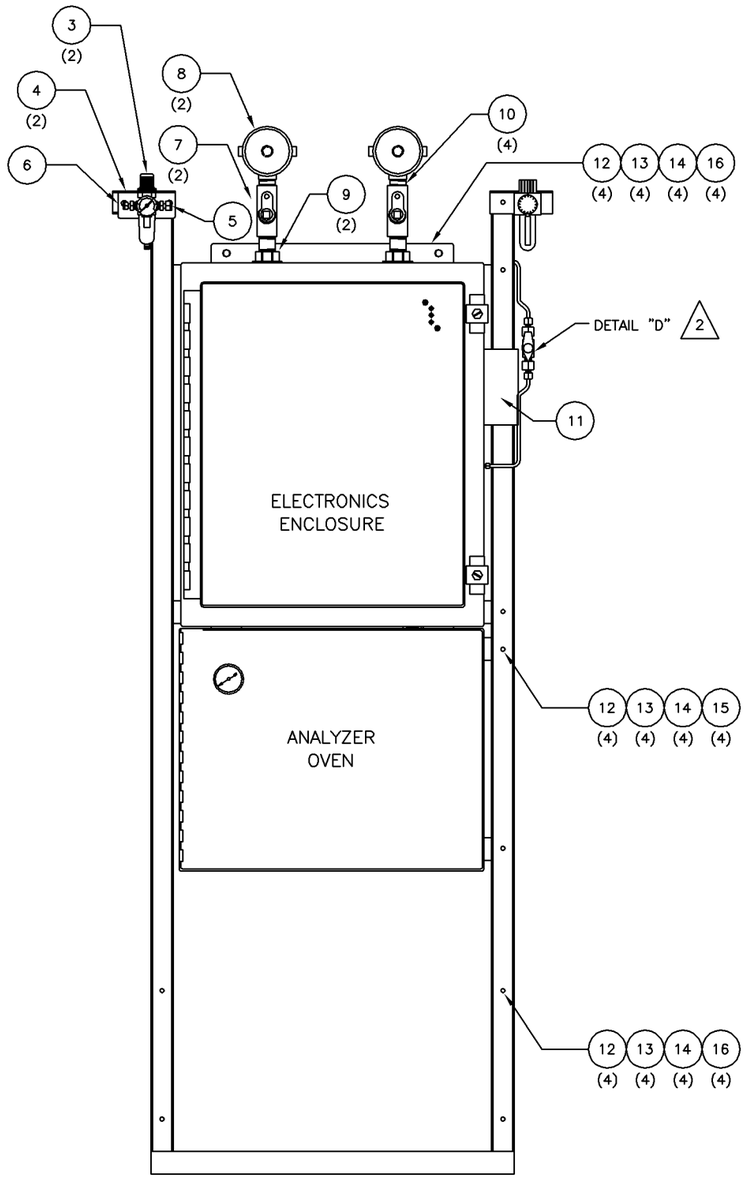
EMERSON Process Management

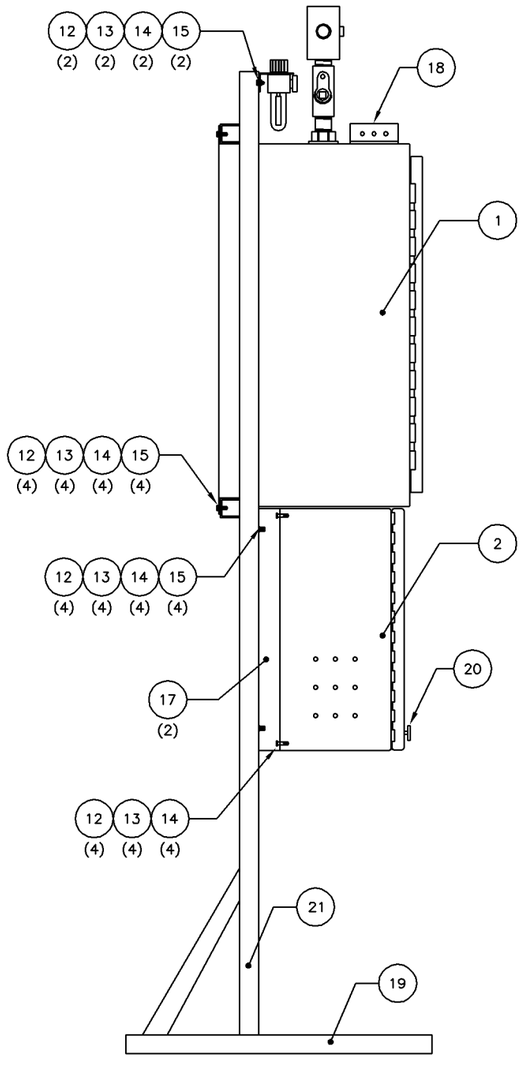
TITLE
INTERNAL CABLE WIRING
ARGON/NITROGEN CARRIER (TCD)
MODEL 1700 FID/TCD
ANALYZER

DRN CC	DATE 7/18/07	DWG NO. DE–21446	REV A
CHKD EM	DATE 10/29/07		
APPD GP	DATE 10/29/07	SCALE NTS P/N SEE ORDER	SHT 2 OF 2

NOTES:

1. 2350 CONTROLLER DOCUMENTED AND ADDED AT TOP LEVEL ASSEMBLY.
2. LOCATION OF ITEMS MAY BE LOCATED DIFFERENTLY ACCOMMODATE OTHER ITEMS OF TOP LEVEL BILL OF MATERIAL.





SI METRIC						
THIRD ANGLE PROJECTION						
MATERIAL: SEE ORDER						
FINISH: SEE ORDER	A	9-20-07	CC	RELEASED	EM	HO
PROJ. FILE NO. – NONE	REV	DATE	DRN	DESCRIPTION	CHKD	APPD

FILENAME: DE21613A1.dwg, DATE: 09-20-07, TIME: 11:01 A.M.

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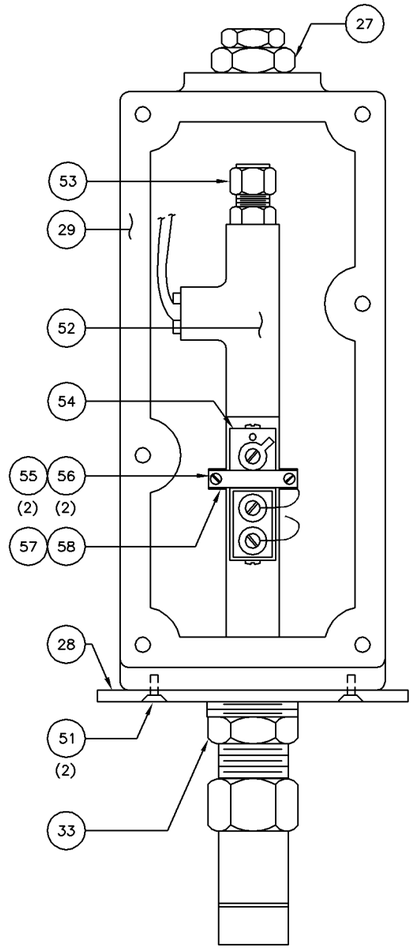
X.XX ±.015
X.XXX ±.005
ANGULAR ±0° 30'
FINISH 200 RA MAX

BREAK ALL SHARP CORNERS TO .003-.015 RADIUS AND REMOVE ALL BURRS

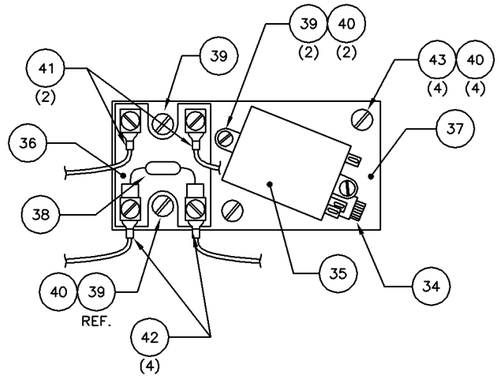
EMERSON Process Management

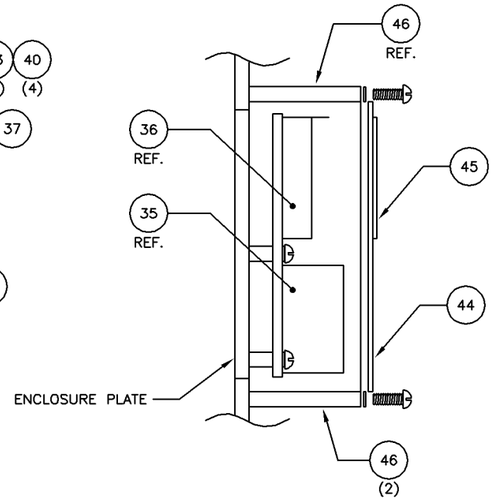
TITLE: ASSEMBLY MODEL 1700

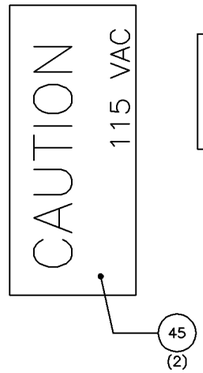
DRN CC	DATE 6/27/07	DWG NO. DE-21613	REV A
CHKD EM	DATE 9/20/07		
ENG. HO	DATE 9/20/07	SCALE NTS P/N SEE ORDER	SHT 1 OF 4

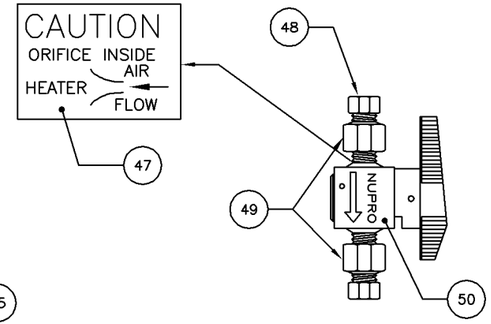


DETAIL "B"

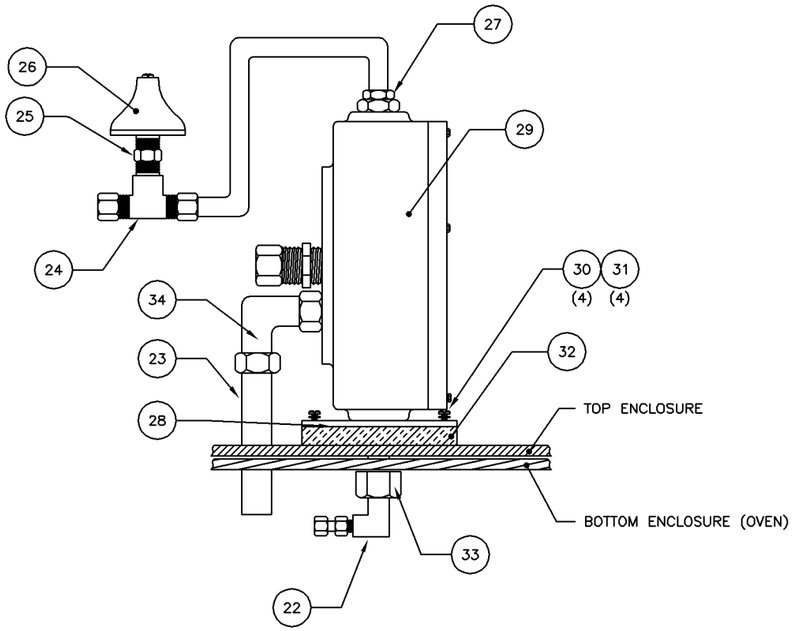








DETAIL "D" ASSEMBLY



DETAIL "B" ASSEMBLY

SI METRIC						
THIRD ANGLE PROJECTION						
MATERIAL: SEE ORDER						
FINISH: SEE ORDER						
PROJ. FILE NO. – NONE						
	A	9–20–07	CC	RELEASED	EM	HO
	REV	DATE	DRN	DESCRIPTION	CHKD	APPD
	FILENAME: DE21613A2.dwg, DATE: 09–20–07, TIME: 11:03 A.M.					

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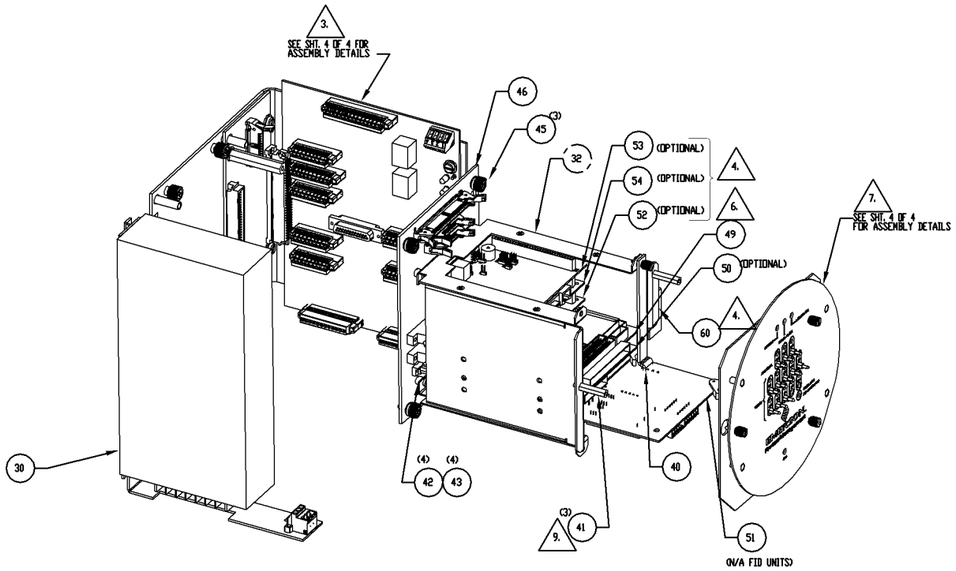
X.XX ±.015
X.XXX ±.005
ANGULAR ±0° 30'
FINISH 200 RA MAX

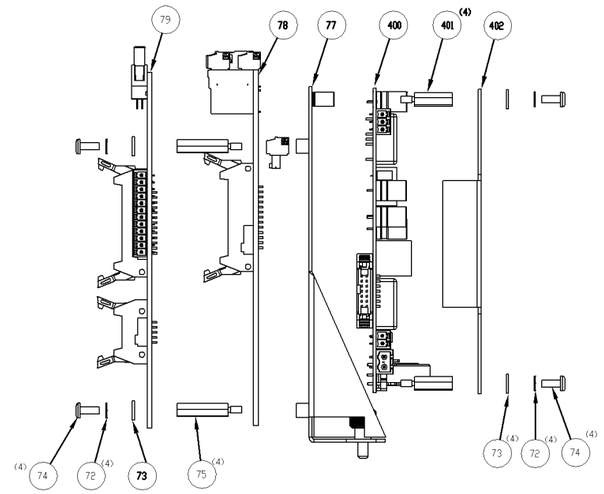
BREAK ALL SHARP CORNERS TO .003–.015 RADIUS AND REMOVE ALL BURRS

EMERSON. Process Management

TITLE: ASSEMBLY MODEL 1700

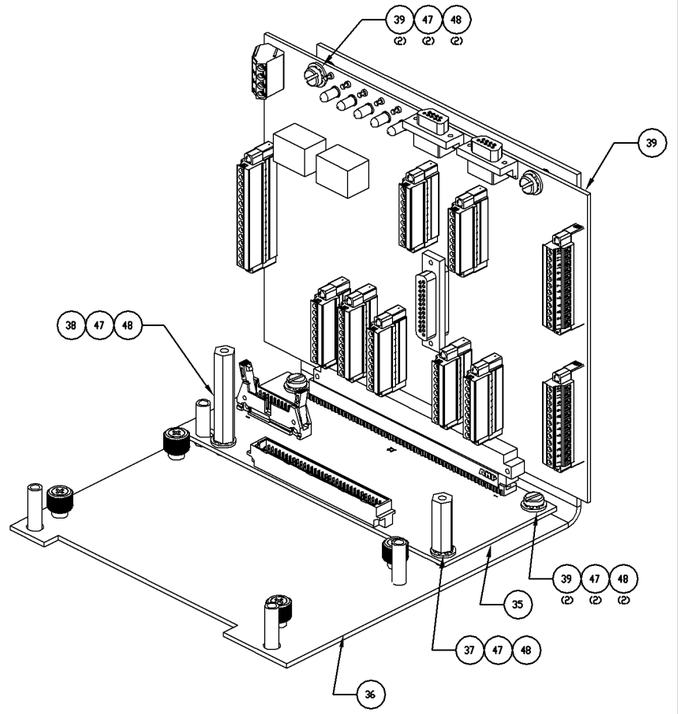
DRN CC	DATE 6/27/07	DWG NO. DE–21613	REV A
CHKD EM	DATE 9/20/07		
ENG. HO	DATE 9/20/07	SCALE NTS P/N SEE ORDER	SHT 2 OF 4





CONTROL CARD ASSEMBLY: FID OPTION

P/N	ITEM	DESCRIPTION
2-3-0700-056	68	DRVR I/O BD ITEM 78 J1 TO MULTI, B.D. ITEM 79 J3
2-3-0700-056	405	DRVR I/O BD ITEM 78 TB4 TO MULTI, B.D. ITEM 79 TB1



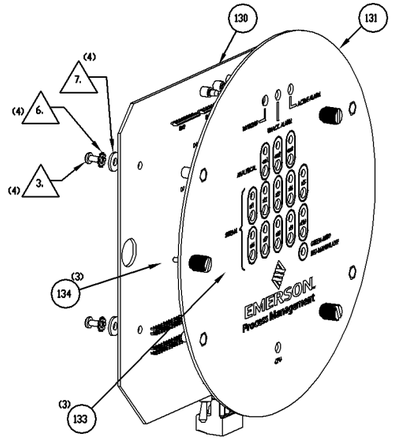
CONTROL CARD ASSEMBLY: TCD OPTION

P/N	ITEM	DESCRIPTION
2-3-0700-056	68	DRVR I/O BD ITEM 78 J1 TO MULTI, B.D. ITEM 79 J3
2-3-0700-051	69	DUAL METHOD ADAP BD ITEM 2 J2 TO MULT. BD. ITEM 79 J2
2-3-0700-052	70	DRVR I/O BD ITEM 78 TB4-1 TO DUAL METHOD ADAP B.D. ITEM 76 J3-1
2-3-0700-059	71	DRVR I/O BD ITEM 78 TB4-1 TO DUAL METHOD ADAP B.D. ITEM 76 J3-3

NOTES:

1. INSTALL QUARTER TURN SCREWS (ITEM 133) THROUGH FRONT PANEL (ITEM 131) AND SECURE WITH RETAINING SPLIT-RING (ITEM 134) USING SOUTHCO 81-0-15129-11 SPLIT-RING INSTALLATION TOOL.

2. SECURE FRONT PANEL (ITEM 131) TO BOARD ASSEMBLY (ITEM 130) WITH SCREWS (ITEM 132), LOCKWASHERS (ITEM 72) AND FLAT WASHERS (ITEM 73).



SI METRIC						
THIRD ANGLE PROJECTION						
MATERIAL: SEE ORDER						
FINISH: SEE ORDER	A	9-20-07	CC	RELEASED	EM	HO
PROJ. FILE NO. - NONE	REV	DATE	DRN	DESCRIPTION	CHKD	APPD

FILENAME: DE21613A3.dwg, DATE: 09-20-07, TIME: 11:02 A.M.

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GEOMETRIC TOLERANCES & DIMENSIONS PER ANSI Y14.5 LATEST REVISION

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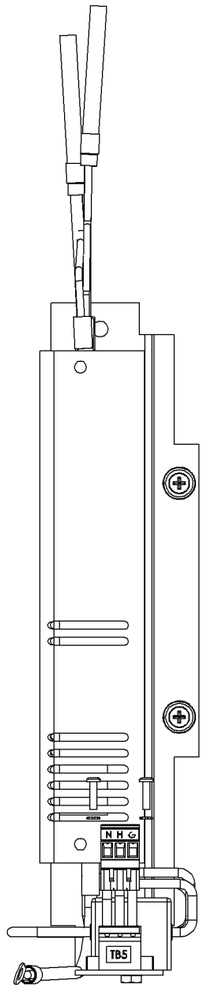
X.XXX ±.005
ANGULAR ±0° 30'
FINISH 200 RA MAX

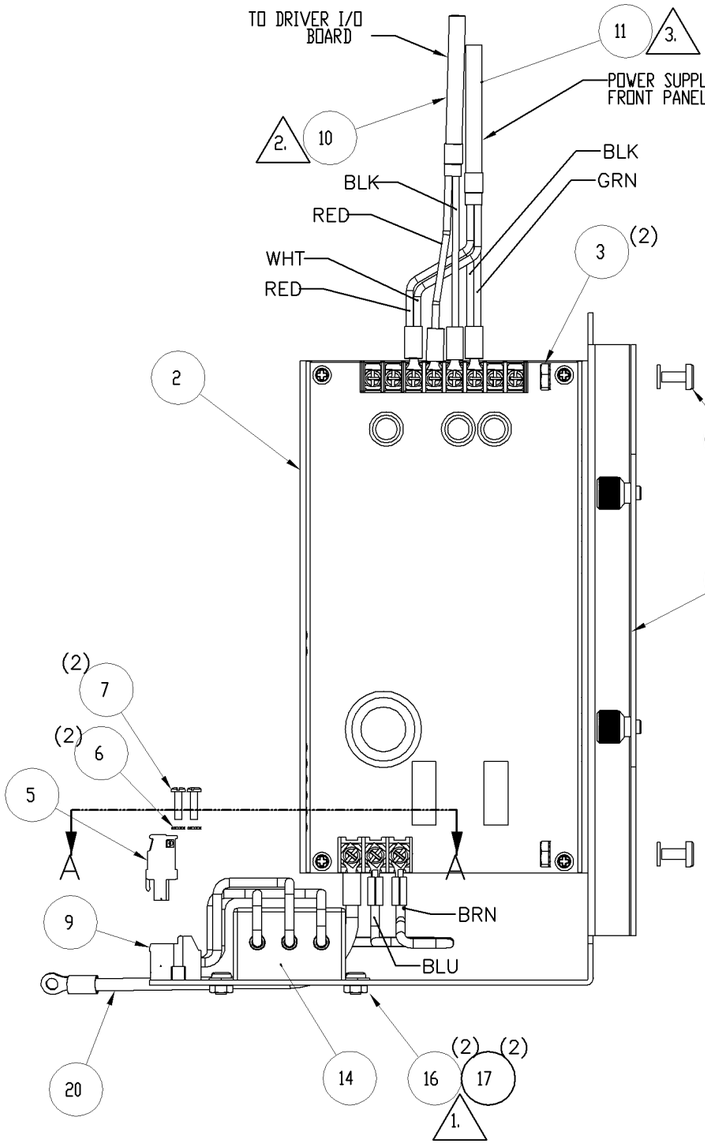
BREAK ALL SHARP CORNERS TO .003-.015 RADIUS AND REMOVE ALL BURRS

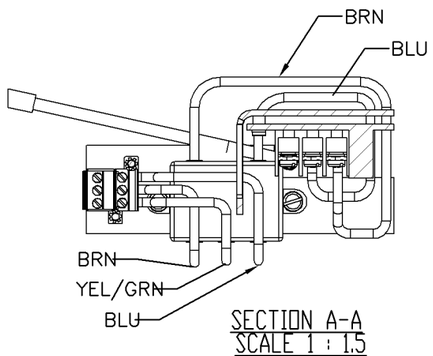
EMERSON. Process Management

TITLE: ASSEMBLIES, CONTROL CARD, FRONT PANEL W/SOLENOID SWITCHING, FIELD TERMINATION PCB MODEL 1700

DRN CC	DATE 7/16/07	DWG NO. DE-21613	REV A
CHKD EM	DATE 9/20/07		
ENG. HO	DATE 9/20/07	SCALE NTS	P/N SEE ORDER	SHT 3 OF 4



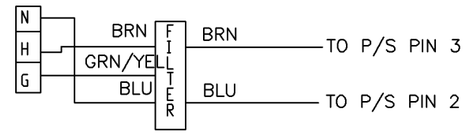




SECTION A-A
SCALE 1 : 1.5

NOTE:

1. IINSTALL LINE FILTER (ITEM 14) ON BRACKET WITH 8-32 SCREWS (ITEM 16) AND KEPNUT (ITEM 17). ALSO INSTALL 3-POS. HEADER (ITEM 9) ON BRACKET WITH 4-40 SCREWS (ITEM 7), AND LOCK WASHERS (ITEM 6).
2. INSTALL DRIVER I/O CABLE (ITEM 10). CONNECT AS FOLLOWS:
   RED TO '+'
   BLACK TO '-S'
3. INSTALL POWER SUPPLY TO FRONT PANEL CABLE (ITEM 11) CONNECT AS FOLLOWS:
   RED AND WHITE TO '+S'
   BLACK AND GREEN TO '-'
4. SECURE POWER SUPPLY (ITEM 2) TO BRACKET (ITEM 1) USING 8-32 SCREWS (ITEM 3), LOCK WASHERS (ITEM 8) AND FLAT WASHERS (ITEM 4).
5. INSTALL PLUG (ITEM 5) INTO HEADER (ITEM 9).
6. WIRE LINE FILTER TO THE P/S AND TB5 PER SCHEMATIC BELOW USING FERRULES (ITEM 15) ON WIRES TO TB5 AND RING LUGS (ITEM 18) ON WIRES TO P/S. ADDITIONALLY INSTALL 2 RING LUGS (ITEM 20) ON 8 INCHES OF GREEN 16 AWG WIRE (ITEM 19) AND INSTALL ONE END ON P/S TERMINAL 'FG'. THE OTHER END WILL BE CONNECTED TO ENCLOSURE GROUND LUG AT UNIT ASSEMBLY.
7. INSTALL A .15 x .55 LABEL WITH N,H,G TO MARK TERMINALS.
8. INSTALL A .25 x .40 LABEL WITH TB5 ON FRONT OF CONNECTOR.



FILTER WIRING

SI METRIC						
THIRD ANGLE PROJECTION						
MATERIAL: SEE ORDER						
FINISH: SEE ORDER	A	9-20-07	CC	RELEASED	EM	HO
PROJ. FILE NO. – NONE	REV	DATE	DRN	DESCRIPTION	CHKD	APPD
	FILENAME: DE21613A4.dwg, DATE: 09-20-07, TIME: 11:04 A.M.					

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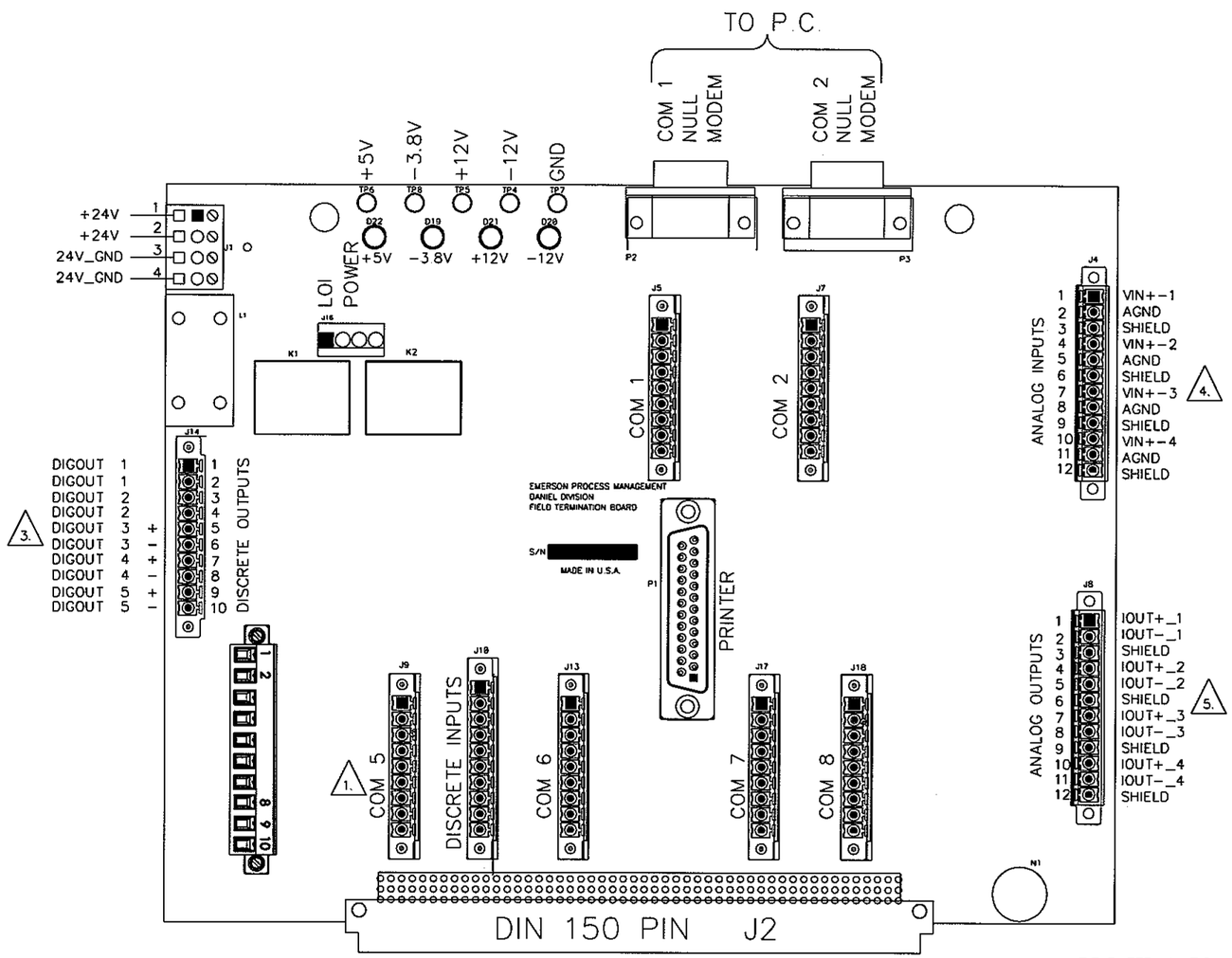
X.XX ±.015
X.XXX ±.005
ANGULAR ±0° 30'
FINISH 200 RA MAX

BREAK ALL SHARP CORNERS TO .003–.015 RADIUS AND REMOVE ALL BURRS

EMERSON. Process Management

TITLE: ASSEMBLIES, CONTROL CARD, FRONT PANEL W/SOLENOID SWITCHING, FIELD TERMINATION PCB MODEL 1700

DRN CC	DATE 7/17/07	DWG NO. DE-21613	REV A
CHKD EM	DATE 9/20/07		
ENG. HO	DATE 9/20/07	SCALE NTS	P/N SEE ORDER	SHT 4 OF 4

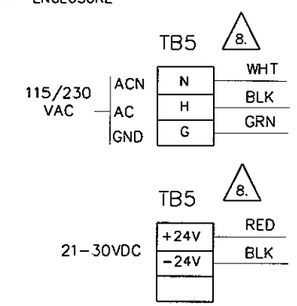


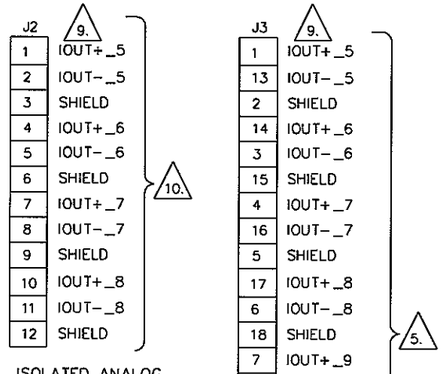
FIELD TERMINATION BOARD

NOTES:

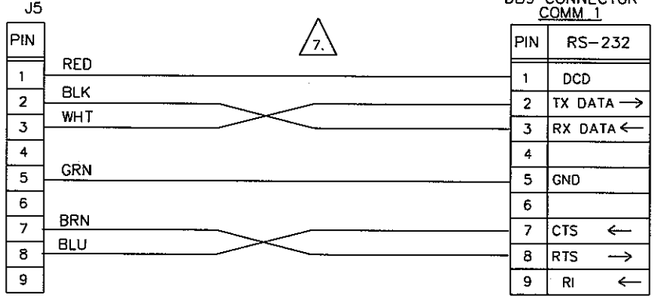
FOR INITIAL UNITS USING P/N 2-3-0580-034 TERMINATION BOARD SEE FIELD WIRING DIAGRAM DE-20992 REV B OR EARLIER

1. IF THE UNIT DOES NOT HAVE THE COM4A BOARD FOR COMMS 5 -8. COMM 4 IS AVAILABLE ON J9. WITH THE COM 4A BOARD INSTALLED. COM 5 IS AVAILABLE ON J9.
2. DISCRETE INPUTS REQUIRE A ISOLATED CONTACT OR OPEN COLLECTOR INPUT. OPEN CIRCUIT VOLTAGE IS 12VDC WITH A 5K OHM RESISTANCE.
3. DISCRETE OUTPUTS 1 AND 2 ARE NORMALLY OPEN RELAY CONTACTS WITH A RATING OF 1A @ 30VDC. ANY INDUCTANCE LOAD SHOULD HAVE TRANSIENT SUPPRESSION. DISCRETE OUTPUTS 3 THROUGHT 5 ARE SOLID STATE SWITCHES WITH A RATING OF 0.375A @ 30VDC AND HAVE A 36V ZENER TRANSIENT SUPPRESSOR ACROSS OUTPUTS.
4. ANALOG INPUTS ARE 4-20MA. THE LOW SIDE IS CONNECTED ANALOG GND. TOTAL INTERNAL RESISTANCE IS 249 OHMS.
5. ANALOG OUTPUTS ARE NON-ISOLATED 4-20MA. THE LOW SIDE IS CONNECTED TO ANALOG GND THROUGH A 15 OHM RESISTOR. RECEIVING DEVICE REQUIRES A DIFFERENTIAL INPUT. OPEN CIRCUIT VOLTAGE IS 11VDC. MAX. EXTERNAL LOAD AT 20MA IS 550 OHMS MINUS 52.1 INTERNAL RESISTANCE MINUS EXTERNAL WIRING RESISTANCE.
6. ALL INPUTS AND OUTPUTS ARE TRANSIENT PROTECTED EXCEPT FOR THE TWO RELAY CONTACT OUTPUTS DIGOUT 1 AND DIGOUT 2.
7. SIX FOOT SERIAL COMMUNICATION CABLE. WIRED TO FIELD TERMINATION BOARD J5 SUPPLIED WITH EACH UNIT.
8. POWER TERMINAL STRIP IS LOCATED ON POWER SUPPLY MOUNTING BRACKET IN LOWER ENCLOSURE.
9. OPTIONAL 8 ANALOG BOARD OR OPTIONAL 4 ISOLATED ANALOG BOARD LOCATED IN LOWER SLOT OF CARDCAGE IN LOWER ENCLOSURE. TERMINAL STRIP IS LOCATED ON FRONT EDGE OF BOARD.
10. OPTIONAL ISOLATED 4 ANALOG OUTPUT BOARD PROVIDES 24 VOLTS LOOPBACK POWER FOR EACH OUPUT. ALL OUTPUTS ARE COMPLETELY ISOLATED FROM EACH OTHER. THE OPEN CIRCUIT VOLTAGE IS 24V. THE MAXIMUM LOAD AT 20mA IS 1.2K OHMS MINUS 40.5 OHMS INTERNAL RESISTANCE MINUS EXTERNAL WIRING RESISTANCE.
11. ETHERNET RJ45 CONNECTOR IS LOCATED ON THE SIDE OF THE CARD CAGE IN THE 700 LOWER ENCLOSURE.





COMMUNICATION CONNECTIONS
FIELD TERMINATION BD. J5 — DB9 CONNECTOR COMM 1



COMMUNICATION CONNECTIONS
J5, J7, J9, J13, J17, & J18 — 1.

PIN	RS-232	RS-485	RS-422
1	DCD	N/C	N/C
2	RX DATA ←	RX/TX+	TX+
3	TX DATA →	RX/TX-	TX-
4	DTR →	N/C	N/C
5	GND	GND	GND
6	DSR ←	N/C	RX+
7	RTS →	N/C	RX-
8	CTS ←	N/C	N/C
9	RI ←	N/C	N/C

COMMUNICATION CONNECTIONS
P2 AND P3 (NULL MODEM) COMM 1, & 2

PIN	RS-232
1	DCD
2	TX DATA →
3	RX DATA ←
4	DSR ←
5	GND
6	DTR →
7	CTS ←
8	RTS →
9	RI ←

DISCRETE INPUTS
J10 CONNECTOR — 2.

PIN	RS-232
1	DIG_IN1
2	GND
3	DIG_IN2
4	GND
5	DIG_IN3
6	GND
7	DIG_IN4
8	GND
9	DIG_IN5
10	GND

CARRIER PRESSURE SWITCH (OPTIONAL)

SI METRIC	G	9-12-06	DLT	ECO XX-5002254	EM	DLT
THIRD ANGLE PROJECTION	F	10-13-04	HM	ECO XX-5000196	EM	DLT
	E	8-10-04	DLT	ECO XX-5000003	DLT	GM
MATERIAL: BLOCK N/A	D	6-10-04	HM	ECO XX-203565	EM	DLT
	C	3-23-04	DLT	ECO XX-200113	DLT	GM
FINISH: BLOCK N/A	B	3-8-04	DLT	ECO XX-199533	EM	DLT
	A	1-29-04	HM	REL'D XX-196577	DLT	GM
PROJ. FILE NO. G-00001	REV	DATE	DRN	DESCRIPTION	CHKD	APPD

FILENAME: DE20992G1.DWG, DATE: 09-11-06, TIME: 4:14 P.M.

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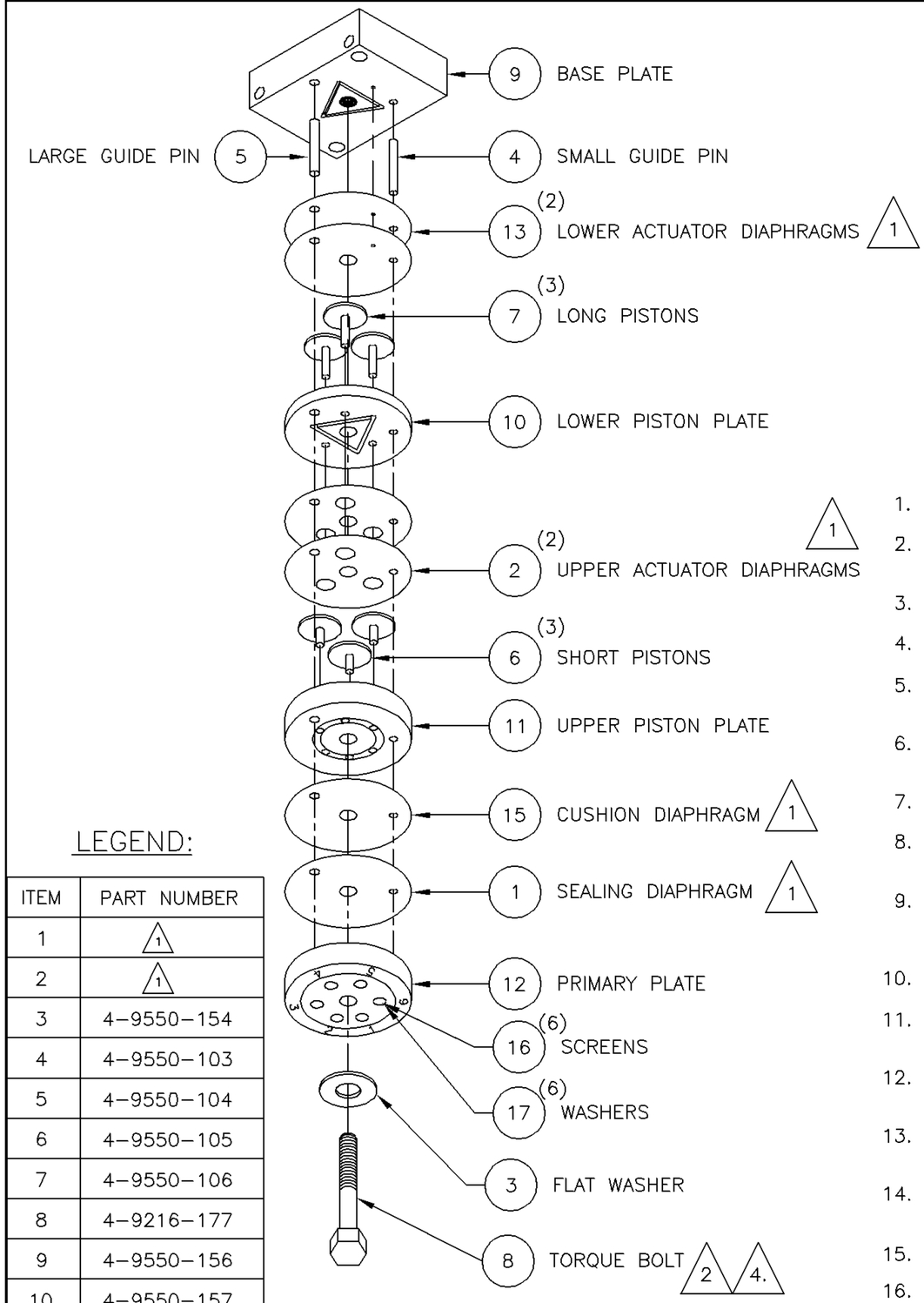
X.XX ±.010
X.XXX ±.003
ANGULAR ±0° 30'
FINISH 100.0 MAX

BREAK ALL SHARP CORNERS TO .003-.015 RADIUS AND REMOVE ALL BURRS

EMERSON Process Management

DRN DLT	DATE 9/2/03	DWG NO. DE-20992	REV G
CHKD DLT	DATE 1-29-04		
APPD GM	DATE 1-29-04	SCALE NTS	P/N N/A	SHT 1 OF 1

TITLE: FIELD WIRING MODEL 700 G C



LEGEND:

ITEM	PART NUMBER
1	△1
2	△1
3	4-9550-154
4	4-9550-103
5	4-9550-104
6	4-9550-105
7	4-9550-106
8	4-9216-177
9	4-9550-156
10	4-9550-157
11	4-9550-152
12	4-9550-153
13	△1
14	NOT USED
15	△1
16	9-9960-148
17	4-9550-114

NOTES:

△1 DIAPHRAGM KIT P/N 3-9300-107 IS USED FOR ALL APPLICATIONS.

△2 CLEAN THREADS OF TORQUE BOLT ITEM #8 WITH WIRE BRUSH WHEEL BEFORE PARTS STAGING.

△3 ALL PARTS OF VALVE MUST BE FREE OF OIL, DUST AND FINGER PRINTS. BEFORE PARTS ARE INSTALLED THEY MUST BE CLEAN AND BLOWN WITH LOW PRESSURE HELIUM.

△4. PRIOR TO INSTALLING THE BOLT, PLACE A SINGLE DROP OF WD-40 ON THE FIRST FEW THREADS, THEN BLOW OFF EXCESS WITH AIR.

6 PORT VALVE ASSEMBLY INSTRUCTIONS

1. ASSEMBLY IS TO BE ACCOMPLISHED BY BUILDING VALVE IN THE UPSIDE DOWN POSITION USING PRODUCTION FIXTURE.
2. INSPECT AND CLEAN THREADS OF ITEM #12 PRIMARY PLATE. INSTALL 2-MICRON SCREENS (ITEM 16) & WASHERS (ITEM 17) IN THE PORTS OF PRIMARY PLATE PER MEP-47623. THEN PLACE INTO HOLES IN PRODUCTION FIXTURE WITH THE GUIDE PIN HOLES FACING UP.
3. INSERT ITEM #5 LARGE GUIDE PIN INTO LARGE GUIDE PIN HOLE IN PRIMARY PLATE.
4. INSERT ITEM #4 SMALL GUIDE PIN INTO SMALL GUIDE PIN HOLE IN PRIMARY PLATE.
5. PLACE ITEM #1 AMBER SEALING DIAPHRAGM (HAVING NO HOLES IN ACTUATING PLANE) OVER PRIMARY PLATE, ALIGN LARGE AND SMALL GUIDE PIN HOLES INTO CORRECT POSITION.
6. PLACE ITEM #15 WHITE CUSHION DIAPHRAGM OVER SEALING DIAPHRAGM, ALIGN LARGE AND SMALL GUIDE PIN HOLES INTO CORRECT POSITION.
7. LOAD ITEM #6 SHORT PISTONS INTO UPPER PISTON PLATE. PISTONS SHOULD FALL FREELY INTO SEATED POSITION.
8. PLACE ITEM #11 UPPER PISTON PLATE OVER GUIDE PINS. PISTON SIDE FACING UP, ALIGN LARGE AND SMALL GUIDE PIN HOLES INTO CORRECT POSITION.
9. PLACE TWO ITEM #2 ACTUATOR UPPER DIAPHRAGMS (THICK-LARGE HOLES IN PISTON SHAFT ACTUATING PLANE) OVER GUIDE PINS, ALIGNING LARGE AND SMALL HOLES INTO CORRECT POSITION. MAKE SURE OPENINGS FOR LONG PISTONS ARE OVER HOLES SO THEY MAY FALL THROUGH THEM.
10. LOAD ITEM #7 LONG PISTONS INTO LOWER PISTON PLATE. PISTONS SHOULD FALL FREELY INTO SEATED POSITION.
11. PLACE ITEM #10 LOWER PISTON PLATE OVER GUIDE PINS, PISTON SIDE FACING UP. ALIGN LARGE AND SMALL GUIDE PIN HOLES INTO CORRECT POSITION.
12. PLACE TWO ITEM #13 ACTUATOR LOWER DIAPHRAGMS (THICK-SMALL HOLES IN PISTON SHAFT ACTUATING PLANE) OVER GUIDE PINS, ALIGNING LARGE AND SMALL GUIDE PIN HOLES INTO CORRECT POSITION.
13. LINE BASE PLATE UP WITH LARGE AND SMALL GUIDE PINS. BRING ITEM #9 BASE PLATE TOGETHER WITH VALVE ASSEMBLY, PUSHING GUIDE PINS INTO BASE PLATE.
14. GUIDE HEX HEAD TORQUE BOLT WITH FLAT WASHER INTO BASE PLATE WITH VALVE IN PRODUCTION FIXTURE. HOLD DOWN ON BASE UNTIL BOLT IS FULLY THREADED AND FINGER TIGHT INTO BASE.
15. CLAMP VALVE BASE PLATE IN VISE AND TIGHTEN TORQUE BOLT TO A FULL 30 FOOT/POUNDS USING TORQUE WRENCH.
16. TAG VALVE WITH P/N, BAG AND SEAL FOR STOCK.

SI METRIC						
THIRD ANGLE PROJECTION	F	5-3-05	HM	ECO-XX-5000713	EM	SLT
	E	8-3-04	HM	ECO-XX-212474	EM	HS
	D	10-7-03	HM	ECO-XX-187989	EM	LF
	C	4-03-03	HM	ECO-XX-172542	EM	HS
MATERIAL N/A	B	12-20-00	RD	ECO-XX-102475	EM	SB
FINISH N/A	A	02/16/00	RD	ECO-XX-60272	EM	RH
PROJ. FILE NO. - NONE	REV	DATE	DRN	DESCRIPTION	CHKD	APPD

FILENAME: CE20234F1.DWG, DATE: 04-28-05, TIME: 12:47 A.M.

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GEOMETRIC TOLERANCES & DIMENSIONS PER ANSI Y14.5 LATEST REVISION

UNLESS OTHERWISE NOTED ALL DIMENSIONS IN INCHES
X.XX ±.015
X.XXX ±.005
ANGULAR ±0 30'
FINISH 200 RA MAX

BREAK ALL SHARP CORNERS TO .003-.015 RADIUS AND REMOVE ALL BURRS

EMERSON. Process Management

TITLE
ASSEMBLY
VALVE, 6-PORT, CHROMATOGRAPH
TRIANGULAR GAS PATH (TGP)
ALL APPLICATIONS

DRN RD	DATE 12/06/99	DWG NO. CE-20234		REV F	
CHKD EM	DATE 01/21/00				
APPD RH	DATE 02/16/00	SCALE 1/2	P/N 3-9207-102	SHT 1 OF 1	

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